Testing the role of social isolation and social cognition in thought disorder in service users diagnosed with psychosis

Paulo Alexandre Brito de Sousa

Submitted in partial fulfilment of the Doctorate in Clinical Psychology

Supervisors:

Professor Richard Bentall (University of Sheffield)

Professor William Sellwood (Lancaster University)

4th June 2018

Word Count: 24299

Acknowledgements

Firstly, I would like to thank my wife, Filomena, for her patience and support throughout the last 3 years of DClinPsy (…after having put up with 3½ years of Ph.D.). I dedicate this thesis to her, my mum (Cidália), my dad (José), my brother (Rui), my father-in-law (Mário), my sister-in-law (Lita), my nephew (André), and my late dog, Alfredo.

Secondly, I would like to thank both my supervisors, Richard and Bill. They have been fantastic research mentors and a source of constant inspiration throughout both my Ph.D. and DClin. They have fostered my curiosity and my appetite for psychological research and it has been an absolute honour and a privilege to learn from both of them.

Thirdly, I would also like to acknowledge and thank all the service users that accepted to take part in my study as well as the Mersey Care and CWP professionals that have supported my research. My empirical study would not have been possible without their help and support.

Table of Contents

List of Tables

List of Figures

Introductory chapter: Thesis overview

Thought disorder (TD) is a common and transdiagnostic feature in service users diagnosed with psychotic-spectrum disorders (e.g. schizophrenia; Roche, Creed, MacMahon, Brennan, & Clarke, 2014) and mood disorders (e.g. bipolar affective disorder; Yalincetin et al., 2016). The construct refers to a varied array of experiences ranging from *poverty of speech* (i.e. replies to questions are marked by a significant reduction in the amount of spontaneous speech), *derailment* (i.e. the discourse of the service user is marked by a sequence of apparently unrelated or remotely related ideas) or *tangentiality* (i.e. service user's replies appear to be tangential and off-topic). These experiences occur on a spectrum of severity ranging from mild and subtle speech atypicalities (e.g. *word approximations*) to *incoherence* and complete breakdown in communication between service user and interlocutor (Andreasen, 1982, 1986).

There has been a considerable amount of research on TD in the last 50 years (McKenna & Oh, 2005). Much of this research effort has neglected the potential role of social factors in TD in favour of a genetic- or biological-oriented research agenda (e.g. Levy et al., 2010; Sumner, Bell, & Rossell, 2018) with some notable exceptions (e.g. Tienari & Wahlberg, 2008; Wahlberg et al., 2000). This has led to a paucity of models to inform and support specific psychological interventions for TD, especially models that bring together psychological mechanisms and social determinants (Bentall et al., 2014). This is an important point given the negative impact that TD has on therapeutic alliance (Cavelti, Homan, & Vauth, 2016) and the importance of the latter construct in the effective delivery of cognitive behavioural therapy for psychosis (CBT*p*; Goldsmith, Lewis, Dunn, & Bentall, 2015), which remains as one of the few gold standard psychological interventions for psychosis (National Institute for Health and Care Excellence; NICE, 2014). The importance of researching TD is

further emphasised by the negative impact that it has on social (Bowie, Gupta, & Holshausen, 2011; Bowie & Harvey, 2008) and occupational functioning (Racenstein, Penn, Harrow, & Schleser, 1999; St-Hilaire & Docherty, 2005), quality of life (Tan, Thomas, & Rossell, 2014), and relapse (Wilcox, 1990).

Some authors proposed adaptations of existing clinical models of psychosis to intervene in TD (Palmier-Claus et al., 2017). These helpful clinical models focus predominantly on the potential role of cognitive appraisals in the maintenance of TD (Beck, Rector, Stolar, & Grant, 2009; Grant & Beck, 2009). They suggest that unhelpful appraisals (e.g. "other people think I am stupid") exacerbate negative affect (e.g. anxiety), which in association with unhelpful behaviours (e.g. hypervigilance), lead to the worsening of TD. These models have the power to explain the well-documented worsening of TD during periods of heightened arousal and anxiety (Docherty, 1996) but they do not explain why the service user would come across as thought *disordered*. Moreover, these models do not attempt to explicitly explore the relationship between well-established psychological mechanisms in TD and social factors. Such effort is important because it is likely to inform more specific maintenance and developmental models of TD.

In recent years, evidence has accumulated supporting the value of TD in the prediction of transition to psychosis in at-risk mental states (ARMS; Bearden, Wu, Caplan, & Cannon, 2011; Cannon et al., 2008; DeVylder et al., 2014), and in high-risk children long before the onset of illness (Gooding, Ott, Roberts, & Erlenmeyer-Kimling, 2012; Ott, Roberts, Rock, Allen, & Erlenmeyer-Kimling, 2002). These findings open important avenues for preventative work and highlight the importance of understanding not just how TD is maintained but also how it develops.

In this context, the current thesis is an attempt to bring together both psychological mechanisms and social determinants of TD with the aim of understanding why service users

appear thought *disordered*. Some authors have suggested that poor *theory-of-mind* (ToM) is an important core process in TD and in symptoms of disorganisation in psychosis (Frith, 1992; Hardy-Baylé, Sarfati, & Passerieux, 2003). TD is manifested through communication and communication is ultimately a social and interpersonal process (Clark & Wilkes-Gibbs, 1986). It follows that a difficulty inferring or monitoring the thoughts, intentions, emotions and state of knowledge of the listener during communication (i.e. poor ToM or an unawareness of the perspective of the listener; Harrow, Lanin-Kettering, & Miller, 1989) would render the service user vulnerable to communication breakdown and to an unawareness that communication has gone awry. However, other domains of socio-cognitive functioning may well be relevant to explain a construct that is highly heterogeneous (Cuesta & Peralta, 1999). Aspects of social cognition such as social perception or emotion recognition could also potentially explain communication difficulties such as TD (Docherty et al., 2013). Importantly, the strength of association between the different domains of social cognition and TD (and related constructs) has not been previously quantified. In this context, Chapter 1 of the dissertation reports on a meta-analytic review (studies published between 1980 and 2016) on the association between different domains of socio-cognitive functioning and TD (and related constructs).

The meta-analysis revealed a significant relationship of moderate strength between TD (and related constructs) and poor performance on ToM and emotion recognition tasks. It is worth mentioning that despite the suggestion of publication bias in the analyses, the recalculation of the point estimate with potential missing studies using the ”trim and fill” procedure still produced a sizable and significant effect-size. Unfortunately, the majority of the studies did not control or adjust for symptom co-morbidity (i.e. co-occurrence of negative symptoms, suspiciousness, and hallucinations) nor did they explore the relationship between poor socio-cognitive functioning and the potential social determinants of TD. These points

are important to explore the specificity of these processes and factors in TD (given the relative overlap between TD and other psychotic experiences). Finally, in the discussion section of the paper findings are interpreted and contextualised within modern models of human communication that highlight the importance of ToM (Pickering & Garrod, 2006) or more generally speaking, of social cognition in conversational grounding (Clark & Brennan, 1991).

The Chapter 2 of the dissertation reports on an empirical study with 68 participants diagnosed with psychotic-spectrum disorders that tested the effects of social isolation on poor ToM, and TD. It has been previously shown that social isolation is a specific predictor of TD (de Sousa, Spray, Sellwood, & Bentall, 2015) and given the sizable relationship between socio-cognitive functioning and TD a more complex mediation model was tested. It was hypothesised that poor ToM could work as mediating factor between social isolation and TD (i.e. the lack of social feedback in social isolation could impact on the service user's social cognition leading to TD). In order to test for symptom-specificity, the regression model was adjusted for the presence of hallucinations, suspiciousness, delusions, and negative symptoms. Interestingly, the analyses revealed that poor performance on the Hinting task fully mediated the relationship between social isolation and TD. Also, relevant was the independent contribution in the final model of delusions. We interpreted the latter finding as supportive of the previous suggestion that TD patients tend to intermingle worries and concerns (e.g. delusional beliefs) into their communications making them idiosyncratic, difficult to follow, and more likely to be labelled as "thought disordered" (Lanin-Kettering & Harrow, 1985).

The potential clinical implications of the two papers comprising this thesis, as well as the limitations of the studies and avenues for future research, are explored in the respective chapters.

References

Andreasen, N. C. (1982). Should the term “thought disorder” be revised? *Comprehensive Psychiatry*, *23*(4), 291.

Andreasen, N. C. (1986). Scale for the assessment of thought, language, and communication (TLC). *Schizophr Bull*, *12*(3), 473–482. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3764363

Bearden, C. E., Wu, K. N., Caplan, R., & Cannon, T. D. (2011). Thought disorder and communication deviance as predictors of outcome in youth at clinical high risk for psychosis. *Journal of the American Academy of Child and Adolescent Psychiatry*, *50*, 669–680. http://doi.org/10.1016/j.jaac.2011.03.021

Beck, A. T., Rector, N. A., Stolar, N., & Grant, P. (2009). *Schizophrenia: Cognitive theory, research, and therapy*. New York: Guilford Press.

Bentall, R. P., Sousa, P. de, Varese, F., Wickham, S., Sitko, K., Haarmans, M., & Read, J. (2014). From adversity to psychosis: pathways and mechanisms from specific adversities to specific symptoms. *Social Psychiatry and Psychiatric Epidemiology*, 1–12. http://doi.org/10.1007/s00127-014-0914-0

Bowie, C. R., Gupta, M., & Holshausen, K. (2011). Disconnected and underproductive speech in schizophrenia: Unique relationships across multiple indicators of social functioning. *Schizophrenia Research*, *131*, 152–156. http://doi.org/10.1016/j.schres.2011.04.014

Bowie, C. R., & Harvey, P. (2008). Communication abnormalities predict functional outcomes in chronic schizophrenia: Differential associations with social and adaptive functions. *Schizophrenia Research*, *103*, 240–247. http://doi.org/10.1016/j.schres.2008.05.006

Cannon, T. D., Cadenhead, K., Cornblatt, B., Woods, S. W., Addington, J., Walker, E., …

Heinssen, R. (2008). Prediction of psychosis in youth at high clinical risk: a multisite longitudinal study in North America. *Archives of General Psychiatry*, *65*, 28–37. http://doi.org/10.1001/archgenpsychiatry.2007.3

Cavelti, M., Homan, P., & Vauth, R. (2016). The impact of thought disorder on therapeutic alliance and personal recovery in schizophrenia and schizoaffective disorder: An exploratory study. *Psychiatry Research*, *239*, 92–98. http://doi.org/10.1016/j.psychres.2016.02.070

Clark, H. H., & Brennan, S. E. (1991). Grounding in communication. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 127–149). Washington, DC: American Psychological Association.

Clark, H. H., & Wilkes-Gibbs, D. (1986). Referring as a collaborative process. *Cognition*, *22*(1), 1–39. http://doi.org/10.1016/0010-0277(86)90010-7

Cuesta, M., & Peralta, V. (1999). Thought disorder in schizophrenia. Testing models through confirmatory factor analysis. *European Archives of Psychiatry and Clinical Neuroscience*, *249*(2), 55–61.

de Sousa, P., Spray, A., Sellwood, W., & Bentall, R. P. (2015). "No man is an island". Testing the specific role of social isolation in formal thought disorder. *Psychiatry Research*, *230*(2), 304–13. http://doi.org/10.1016/j.psychres.2015.09.010

DeVylder, J. E., Muchomba, F. M., Gill, K. E., Ben-David, S., Walder, D. J., Malaspina, D., & Corcoran, C. M. (2014). Symptom trajectories and psychosis onset in a clinical high-risk cohort: The relevance of subthreshold thought disorder. *Schizophrenia Research*, *159*(2–3), 278–283. http://doi.org/10.1016/j.schres.2014.08.008

Docherty, N. (1996). Affective reactivity of symptoms as a process discriminator in schizophrenia. *The Journal of Nervous and Mental Disease*, *184*(9), 535–541.

Docherty, N., McCleery, A., Divilbiss, M., Schumann, E. B., Moe, A., & Shakeel, M. K.

(2013). Effects of social cognitive impairment on speech disorder in schizophrenia. *Schizophr Bull*, *39*(3), 608–616. http://doi.org/10.1093/schbul/sbs039

Frith, C. D. (1992). *The cognitive neuropsychology of schizophrenia*. Psychology Press.

Goldsmith, L. P., Lewis, S. W., Dunn, G., & Bentall, R. P. (2015). Psychological treatments for early psychosis can be beneficial or harmful, depending on the therapeutic alliance: an instrumental variable analysis. *Psychological Medicine, 45*, 2365–2373. http://doi.org/10.1017/s003329171500032x

Gooding, D. C., Ott, S. L., Roberts, S. A., & Erlenmeyer-Kimling, L. (2012). Thought disorder in mid-childhood as a predictor of adulthood diagnostic outcome: findings from the New York High-Risk Project. *Psychological Medicine*. http://doi.org/10.1017/S0033291712001791

Grant, P. M., & Beck, A. T. (2009). Evaluation sensitivity as a moderator of communication disorder in schizophrenia. *Psychological Medicine*, *39*(7), 1211.

Hardy-Baylé, M.-C., Sarfati, Y., & Passerieux, C. (2003). The cognitive basis of disorganization symptomatology in schizophrenia and its clinical correlates. *Schizophrenia Bulletin*, *29*(3), 459–471.

Harrow, M., Lanin-Kettering, I., & Miller, J. G. (1989). Impaired perspective and thought pathology in schizophrenic and psychotic disorders. *Schizophrenia Bulletin, 15*, 605–623. http://doi.org/10.1093/schbul/15.4.605

Lanin-Kettering, I., & Harrow, M. (1985). The thought behind the words: A view of schizophrenic speech and thinking disorders. *Schizophrenia Bulletin*, *11*, 1–15.

Levy, D. L., Coleman, M. J., Sung, H., Ji, F., Matthysse, S., Mendell, N. R., & Titone, D. (2010). The genetic basis of thought disorder and language and communication disturbances in schizophrenia. *J Neurolinguistics*, *23*(3), 176. http://doi.org/10.1016/j.jneuroling.2009.08.003

McKenna, P. J., & Oh, T. M. (2005). *Schizophrenic speech: Making sense of bathroots and ponds that fall in doorways*. Cambridge University Press.

NICE (2014). *Psychosis and schizophrenia in adults: Treatment and management (update)* (NICE). London: England: National Institute for Health and Care Excellence. Retrieved from http://www.nice.org.uk/guidance/index.jsp?action=byID&o=14382

Ott, S. L., Roberts, S., Rock, D., Allen, J., & Erlenmeyer-Kimling, L. (2002). Positive and negative thought disorder and psychopathology in childhood among subjects with adulthood schizophrenia. *Schizophrenia Research*, *58*(2), 231–239.

Palmier-Claus, J., Griffiths, R., Murphy, E., Parker, S., Longden, E., Bowe, S., … Tai, S. (2017). Cognitive behavioural therapy for thought disorder in psychosis. *Psychosis*. http://doi.org/10.1080/17522439.2017.1363276

Pickering, M. J., & Garrod, S. (2006). Alignment as the basis for successful communication. In *Research on Language and Computation* (Vol. 4, pp. 203–228). http://doi.org/10.1007/s11168-006-9004-0

Racenstein, J. M., Penn, D., Harrow, M., & Schleser, R. (1999). Thought disorder and psychosocial functioning in schizophrenia: the concurrent and predictive relationships. *The Journal of Nervous and Mental Disease*, *187*, 281–289. http://doi.org/10.1097/00005053-199905000-00003

Roche, E., Creed, L., MacMahon, D., Brennan, D., & Clarke, M. (2014). The epidemiology and associated phenomenology of formal thought disorder: A systematic review. *Schizophrenia Bulletin*. http://doi.org/10.1093/schbul/sbu129

St-Hilaire, A., & Docherty, N. (2005). Language reactivity and work functioning in schizophrenia. *Schizophrenia Research*, *75*(2), 241–246.

Sumner, P. J., Bell, I. H., & Rossell, S. L. (2018). A systematic review of the structural neuroimaging correlates of thought disorder. *Neuroscience and Biobehavioral Reviews*.

http://doi.org/10.1016/j.neubiorev.2017.08.017

Tan, E. J., Thomas, N., & Rossell, S. L. (2014). Speech disturbances and quality of life in schizophrenia: Differential impacts on functioning and life satisfaction. *Comprehensive Psychiatry*, *55*, 693–698. http://doi.org/10.1016/j.comppsych.2013.10.016

Tienari, P., & Wahlberg, K.-E. (2008). Family environment and psychosis. In C. Morgan, K. McKenzie, & P. Fearon (Eds.), *Society and Psychosis* (pp. 112–126). Cambridge, UK: Cambridge University Press.

Wahlberg, K. E., Wynne, L., Oja, H., Keskitalo, P., Anais-Tanner, H., Koistinen, P., … Tienari, P. (2000). Thought disorder index of Finnish adoptees and communication deviance of their adoptive parents. *Psychol Med*, *30*(1), 127–136.

Wilcox, J. A. (1990). Thought disorder and relapse in schizophrenia. *Psychopathology*, *23*, 153–156. http://doi.org/10.1159/000284652

Yalincetin, B., Bora, E., Binbay, T., Ulas, H., Akdede, B. B., & Alptekin, K. (2016). Formal thought disorder in schizophrenia and bipolar disorder: A systematic review and meta-analysis. *Schizophrenia Research*, *185*, 2–8. http://doi.org/10.1016/j.schres.2016.12.015

Chapter 1: Literature review

Title: **Disorganisation and thought disorder and socio-cognitive functioning in psychosis: A meta-analysis**

Target: British Journal of Psychiatry[1]

Word Count: 5288

[1] Manuscript is currently under review with the British Journal of Psychiatry (BJP author guidelines; See Appendix A).

ABSTRACT

Background: Poor social cognition is prevalent in psychosis. Some authors argue that these effects are symptom-specific and that socio-cognitive difficulties (e.g. Theory-of-Mind) are strongly associated with thought disorder (TD) and symptoms of disorganisation. Aims: The current review tests the strength of this association. Method: We meta-analysed studies published between 1980 and 2016 that tested the association between social cognition and these symptoms in schizophrenia. Results: Our search (PsycINFO, MEDLINE and Web of Science) identified 123 studies (N= 9107). Overall effect-size (ES) was r= -0.313, indicating a moderate association between symptoms and social cognition. Sub-analyses yielded a moderate association between symptoms and ToM (r= -0.349), emotion recognition (r= -0.334) but smaller ES for social perception (r= -0.188), emotion regulation (r= -0.169) and attributional biases (r= -0.143). Conclusions: The association is interpreted within models of communication that highlight the importance of mentalisation and processing of partner-specific cues in conversational alignment and grounding.

Declaration of interest: None.

Keywords: schizophrenia; social cognition; theory-of-mind; emotion recognition; social perception; emotion processing.

> "No matter how one may try, one cannot not communicate"
>
> Watzlawick, Bavelas, and Jackson [1(p48)]

1. Background

Researchers in the field of psychosis have long been interested in the role of social cognition in psychotic experiences. [2,3] Consequently, there is now a wealth of meta-analytical evidence showing that deficits in theory-of-mind (ToM; the ability to infer mental states in others), social perception, and emotion recognition are highly prevalent in individuals with diagnoses in the schizophrenia spectrum. [4,5] Some researchers have suggested that impairments in social cognition play a specific role in disorganised symptoms of psychosis, especially thought disorder (TD). [3,6] Here we report a statistical synthesis of the evidence on the association between domains of social cognition and TD and other symptoms of disorganisation in participants diagnosed with psychotic-spectrum disorders.

1.1 Socio-cognitive domains

An NIMH workshop defined social cognition as a set of:

> "(The) mental operations that underlie social interactions, including perceiving, interpreting, and generating responses to the intentions, dispositions, and behaviors of others".
>
> Green et al. [7 (p1211)]

Hence, social cognition is a multi-faceted construct, referring to a broad range of higher-level inferential, attributional and regulatory processes, as well as lower-level social

cue perception and processing. The consensus is that these processes comprise four core domains, namely: ToM and mental state attribution, social perception, attributional style or biases, and emotion processing. [8] Some have distinguished a fifth domain referred to as emotion recognition. This encompasses lower-level emotional cue perception and identification (Socio-cognitive domains and tasks; See Appendix B).

1.1.1. ToM and mental state attribution

ToM (or mental state attribution) refers to the ability of the individual to infer intentions, dispositions and beliefs in others from their speech, actions and/or non-verbal behaviour. [3,9] Relevant assessment tasks may involve reading short passages, describing social interactions, where intentions of the characters are inferred from hints or indirect speech acts (e.g. Hinting task). [2] Alternatively, participants may be asked to sequence picture-card stories that require the correct inference of false beliefs in order to understand the story plot (e.g. Picture-Sequencing Task). [10]

1.1.2. Social perception

Social perception refers to the ability to decode and interpret social cues (verbal and non-verbal) in an interpersonal situation. This involves both the correct interpretation of cues in a social context but also the processing of social knowledge (i.e. the ability to utilise roles, rules and goals in a social situation and the knowledge of how they affect other people's behaviours). In some tasks, participants are presented with social situations followed by multiple-choice questions that test their ability to interpret cues about social roles and rules (e.g. Interpersonal Perception Task). [11] Alternatively, tasks may involve the presentation of

short audio and video clips that test the accurate interpretation of body postures, gestures, facial expressions or voice cues (e.g. Profile of Non-verbal Sensitivity). [12]

1.1.3. Emotion recognition

Emotion recognition refers to the ability to identify human emotion from a range of stimuli and cues such as facial expressions or tone of voice. Emotion recognition tasks may involve the ability to correctly identify different emotional states from video clips of an actor performing facial, vocal-tonal and upper-body movement cues (e.g. Bell-Lysaker Emotion Recognition Task) [13] or the identification of different emotional states from the tone of voice of audio-taped speakers reading out loud sentences of neutral content (e.g. Voice Emotion Identification Test). [14]

1.1.4. Attributional bias/style

Attributional bias refers to quick causal inferences that individuals make about positive and negative social events. These inferences (or attributions) are typically classified as external (i.e. the cause is attributed to others) or internal (i.e. cause is attributed to self). Sometimes, external attributions may be classified as personal (i.e. cause is the actions of another person) or situational (i.e. cause is attributed to situational factors). Tasks involve asking the participants to imagine themselves in a positive or negative social situation and to report the most likely causal explanation for an event. Example measures include the Attributional Style Questionnaire [15] and the Internal, Personal, and Situational Attributions Questionnaire. [16]

1.1.5. Emotion processing and regulation

Emotion processing refers to skills that range from the perception of emotion to the understanding and management (regulation) of emotions. Although, some of these skills overlap with the competencies involved in emotion recognition the construct is broader and encompasses affective regulatory strategies. The assessment of emotional processing can involve questionnaire measures (e.g. Emotion Regulation Questionnaire) [17] or tasks where the participant is asked to rate brief vignettes that tap into the management, regulation or facilitation of emotions (e.g. Mayer-Salovey-Caruso Emotional Intelligence Test). [18]

1.2. Thought disorder and cognitive disorganisation

TD refers to a range of thinking, linguistic and communication atypicalities that render the speech and communication of some individuals difficult to follow and apparently unintelligible. [19] These symptoms are a relatively enduring feature in psychotic patients [20] and have been associated with poorer quality of life, [21] higher rates of readmissions, [22] and poorer occupational and social functioning. [23,24] Perhaps more importantly, TD in psychotic patients has been associated with poor therapeutic alliance, [25] a core process in cognitive behavioural therapy for psychosis. [26] Despite a considerable amount of research in the field, the processes and mechanisms involved in TD are still unclear. [27,28] However, such knowledge may be important for the development of effective psychological treatments for TD.

Some authors have argued that no single mechanism will ever be able to explain the full range of symptoms of TD because it is highly heterogeneous cluster of experiences and behaviours. [27] Although, there is no final word regarding the number of factors involved in TD, [29] it is clear that a distinction can be made between an impoverished speech factor, that includes symptoms such as alogia (or poverty of speech), and a disorganisation factor, which

includes symptoms such as derailment, tangentiality, or incoherence. [30] This dichotomy has also been referred to as negative and positive TD. TD assessment scales such as the Scale for the Assessment of Thought, Language and Communication Disorders (TLC), [31] or the Thought Language Index (TLI), [32] distinguish between poverty of speech and disorganisation items and such differentiation has been further supported by factor analytical studies [33] and studies on the psychological mechanisms of both positive and negative TD. [34,35]

Many studies have used measurements using general psychopathology scales (e.g. Positive and Negative Syndrome Scale [36] or the Brief Psychiatric Rating Scale [37]) to test hypotheses about the mechanisms involved in TD. These include single ratings of conceptual disorganisation or symptom factors. The single ratings are highly correlated with more extensive measures of TD [38] and they capture symptoms of disorganisation such as derailment, incoherence, or illogicality (i.e. positive TD) but not symptoms of cognitive impoverishment such as alogia or poverty of speech. The symptom factors, which are derived from factor analysis and are typically labelled in the literature as 'disorganisation' or 'cognitive' factors, seem to form an orthogonal cluster of experiences distinct from positive and negative symptoms of schizophrenia. [39] They are highly associated with positive TD but not alogia or poverty of speech. [40] A further problem is that they tend to encompass variance from PANSS items such as tension, inappropriate affect, or mannerisms and posturing, experiences that would not normally fall under the category of TD. [41]

For the conceptual and methodological reasons outlined above we felt that it was important that our analytical strategy distinguished between nuanced constructs, which code different and at times distinct phenomena.

1.3. Social cognition, TD and cognitive disorganisation

Perhaps one of the most puzzling findings in TD is that patients seem to be unaware that their verbalisations are idiosyncratic and difficult to follow, despite being able to successfully judge other TD patients' verbalisations as bizarre and atypical. [42] This apparent inability to shift perspective, repair communication, and cooperatively adjust the message to the needs (and level of knowledge) of the listener is crucial when communication goes awry [43] and has been highlighted by several authors as a crucial feature in TD. For example, Frith [3] suggested that difficulties inferring the state of knowledge, intentions, and beliefs of an interlocutor, together with difficulties in interpreting the interlocutor's social signals, could prevent repair when communication fails, thereby leading to speech being perceived by the interlocutor as tangential or derailed. Similarly, Hardy-Baylé and colleagues [6] suggested that symptoms of disorganisation in patients diagnosed with schizophrenia could be explained by difficulties in representing other peoples' mental states and integrating contextual information during conversations. These hypotheses have been partially supported in a review [44] and a meta-analysis[5] of the literature on ToM in patients diagnosed with schizophrenia but difficulties with ToM do not occur in isolation from other kinds of deficits [45] and it is therefore likely that other domains of social cognition may also be important in TD.

For example, Toomey and colleague found significant associations between poor social perception and symptoms of disorganisation in patients [46] and Kee and colleagues found significant associations between disorganization and poor emotion recognition. [47] It is not difficult to offer interpretations of these findings. For example, *stilted speech* (pedantic speech that is excessively formal and inappropriate for the context of the conversation) [31] could be partially explained by poor social perception (speaking with excessive formality when the social context requires a more informal style). Although hypotheses such as this are

speculative at the present time, they highlight the value of exploring a wide range of domains of social cognition in relation to TD and disorganisation.

1.4. Study aim

The aim of the current review was to quantify the strength of the association between different domains of social cognition and TD, disorganisation and alogia in psychosis.

2. Method

The present review was carried out in adherence to the Meta-Analysis of Observational Studies in Epidemiology (MOOSE) guidelines [48] and the general principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement for reporting systematic reviews and meta-analyses (PRISMA checklist; See Appendix C). [49]

2.1. Literature search

After initial scoping searches, three electronic databases (PsycINFO, MEDLINE and Web of Science) were searched for papers published between 1980 and 2016 using the following search terms: social cognition OR theory of mind OR theory-of-mind OR mentali$ation OR mental state attribution OR affect* OR emotion* (recognition or identification or regulation or management or processing or perception) social perception OR social knowledge OR attribution* (bias* or style) AND schizophreni* OR psychos* AND formal thought disorder OR thought dis* OR thinking dis* OR disorgani* OR conceptual dis* OR cognitive dis* OR communication dis*. The three searches yielded a total of 3,077 records (Figure 1).

2.2. Study selection

The inclusion criteria were: (1) the study was published in English language; (2) the paper was fully accessible; (3) the study was published in a peer-reviewed journal; (4) the sample was composed of patients diagnosed with schizophrenia-spectrum disorders; (5) a clear TD or disorganisation measure could be identified; (6) a socio-cognitive measure could be identified; and (6) statistical data were available for extraction.

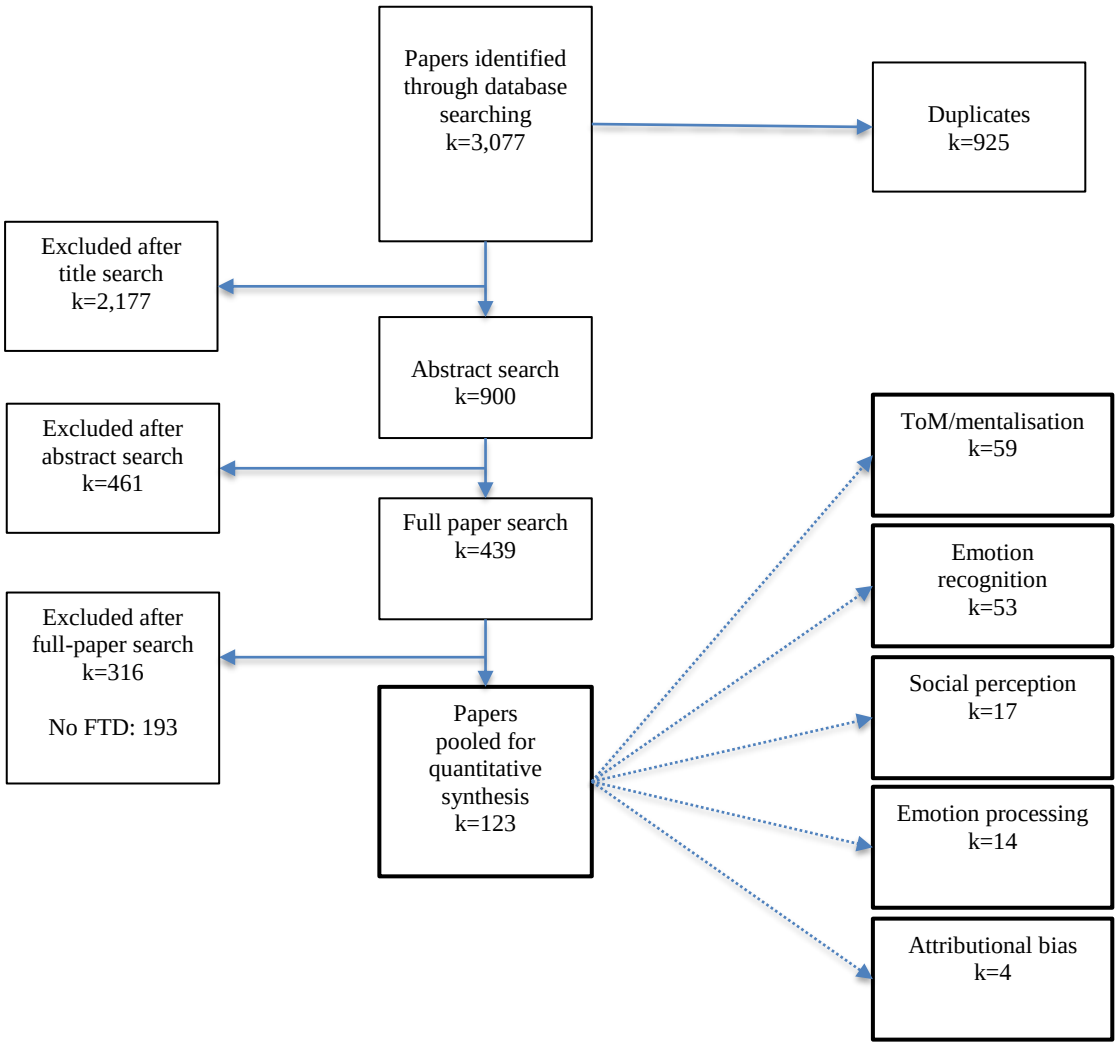


Figure 1. Flowchart of the different stages of the systematic search.

2.3. Symptom grouping strategy

In order to test the impact of different symptoms on social cognition, we organised the effect-sizes (ES) in three different symptom groups: disorganisation (factor), alogia (poverty of speech) and thought disorder (TD). The first group included ES from studies where researchers calculated the association between social cognition and a symptom factor (e.g. 'disorganisation factor' or 'cognitive factor') derived from clinical symptom scale (e.g. PANSS or BPRS). These factors were likely to include variance from symptoms that despite being statistically associated with TD, do not represent what would normally be assumed to fall under remit of the construct (e.g. tension, mannerisms and posturing). [50] The second group (alogia) included ES from studies where extractable data for the association between social cognition and a single item for alogia or poverty of speech was provided. These were almost always clinical symptom scales such as the SANS. [51] Finally, our third group (thought disorder) included data from studies where ES was calculated from a TD-specific scale score (e.g. TLC [52] or Bizarre Idiosyncratic Thinking Scale [53]) or from a single-item (other than alogia or poverty of speech) from a clinical rating scale (e.g. PANSS stereotyped thinking or conceptual disorganisation [54,55]). In these cases, we opted to maintain the original designation used by the authors in Table 2. Included in this symptom group were also ES that had been estimated from clinical symptom scales that have specific TD subscales (e.g. SAPS [56]). The analyses of this group will include a ES for the group as whole and then a second estimate for studies that have used only TD-specific measures (without the scores from single-item clinical rating scales). The reason for this is to understand the strength of the estimate when TD is measure with robust (multi-item) and purposely designed measures.

2.4. Statistical analysis

Statistical analysis was carried out with CMA© (Comprehensive Meta-Analysis). Overall ES was estimated using Pearson's correlation coefficient (r) and random effects analysis given the likelihood that our analysis would carry a substantial amount of variation across studies. In studies with multiple socio-cognitive scores within the same domain, ES was computed from the average across tasks so that overall ES could be computed from a single estimate by study. R-Z transformations were used. For details about coding and data extraction see Appendix D. Heterogeneity was measured with τ^2, Q and with I^2 and sensitivity analysis was carried out with group comparisons and meta-regression. Publication bias was tested by the visual inspection of the funnel plot, Begg and Mazumdar's rank order correlation, Egger's regression intercept, and Duval and Tweedie's "trim and fill" procedure.

3. Results

3.1. Study and sample characteristics

Our search identified 123 studies with extractable data (List of studies included in the meta-analysis; See Appendix E). The demographic and clinical characteristics of the studies can be found in Table 1 and the methodological characteristics can be found in Table 2.

3.2. Overall effect size (ES)

The pooled ES for all the studies combined was r= -0.313 (k= 123; 95%CI [-0.346; -0.279]; z= -17.226; p< 0.001) which indicates a negative correlation of moderate strength. Not surprisingly, there was a significant amount of heterogeneity (Q[122]= 306.702; p< 0.001; I^2= 60.222; τ^2= 0.022; SE= 0.006; var= 0.000; τ= 0.147) likely due to both the clinical and methodological diversity across studies.

Study characteristics		**k=123**
Design	Cross-sectional (%)	114 (92.68%)
	Longitudinal (%)	9 (7.32%)
Sample size	Total	9107
Sex	Male (%)	6338 (69.59%)
	Female (%)	2573 (28.25%)
Age	Mean (sd)	36.61 (6.27)
Status	Outpatient (%)	56 (45.16%)
	Inpatient (%)	31 (25.00%)
	Mixed (%)	37 (29.84%)
Diagnostic label	Schizophrenia (%)	63 (51.22%)
	Spectrum (%)	60 (48.78%)
Diagnostic criteria	DSM-III-R or above (%)	118 (95.93%)
Socio-cognitive domain	ToM (%)	59 (40.14%)
	Social perception (%)	17 (11.56%)
	Emotion recognition (%)	53 (36.05%)
	Attributional biases (%)	4 (2.72%)
	Emotion processing (%)	14 (9.52%)
Symptom	Disorganisation factor (%)	76 (53.15%)
	Alogia (%)	26 (18.18%)
	Thought disorder (%)	23 (16.08%)
	Other (%)	18 (12.59%)
Scale	PANSS/SANS/SAPS/BPRS (%)	106 (86.18%)
	Other (%)	17 (13.82%)

Table 1. Demographic and clinical variables.

Author (1st)	Year	Design	Country	Domain	Task	Symptom	Measure	Sample	Size (n)	Males	Females	Age (±)	Diagnoses	Criteria
Abdel-Hamid	2009	CS	Germany	TOM	PictSeq	Disorg (F)	PANSS	Mixed	50	24	26	37.08 (12.3)	Spectrum	DSM-4
Abram	2014	CS	US	ER	FAP	Disorg (F)	SAPS SANS	Outpatient	59	37	22	35.51 (9.39)	Scz	DSM-4
Allen	2007	CS	US	TOM	PictArrang	Disorg (F)	BPRS	Inpatient	169	169	0	36.2 (7.9)	Scz	DSM-4
Altamura	2015	CS	Italy	TOM	Eyes test	Disorg (F)	PANSS	Outpatient	35	6	24	42.47 (10.4)	Scz	DSM-4-TR
Ayesa-Arriola	2016	LONG	Spain	TOM	Eyes test	Disorg (F)	SAPS SANS	Outpatient	160	86	74	32.17 (10.78)	Spectrum	DSM-4
Barkhof	2015	CS	Netherlands	ER	IFE	Disorg (F)	PANSS	Mixed	98	82	16	35.1 (9.7)	Spectrum	DSM-4
Bellack	1992	CS	US	SP	SPT	Disorg (I)	BPRS	Inpatient	34	25	9	30.3 (7.3)	Scz	DSM-3-R
Bell	2013	CS	US	ER TOM PROC	BLERT Hint SAT-MC MSCEIT	Alogia	PANSS	Outpatient	77	43	34	43.4 (10.4)	Spectrum	DSM-4
Bell	2010	CS	US	TOM	SAT-MC	Disorg (F)	PANSS	Outpatient	66	40	26	42.73 (10.4)	Spectrum	DSM-4
Bell	2009	CS	US	ER TOM	BLERT Hint BORI	TD	Gorham	Outpatient	105	61	44	42.8 (8.9)	Spectrum	DSM-4
Bo	2015	CS	Denmark	TOM	MAS-A	Disorg (I)	PANSS	Mixed	79	64	15	36.9 (10.4)	Scz	DSM-4-TR
Bozikas	2004	CS	Greece	ER	APT Cartoon-F KAMT	Disorg (F)	PANSS	Outpatient	35	21	14	36.51 (10.16)	Scz	DSM-4
Bryson	1997	CS	US	ER	BLERT	TD	Gorham	Outpatient	63	61	2	43.56 (8.18)	Spectrum	DSM-3-R
Brüne	2012	CS	Germany	TOM	MSAT	Disorg (F)	PANSS	Mixed	58	41	17	35.45 (10.3)	Scz	DSM-4
Brüne	2011	CS	Germany	TOM	MSAT PictSeq	Disorg (F)	PANSS	Mixed	69	45	24	36.3 (10.3)	Spectrum	DSM-4
Castagna	2013	CS	Italy	ER	CATS	Disorg (F)	PANSS	Outpatient	94	66	28	41.8 (10.2)	Scz	DSM-4-TR

Chambon	2006	CS	France	ER	FERT	TD Alogia	SAPS SANS	Inpatient	26	20	6	32.1 (7.8)	Scz	DSM-4
Cohen	2009	CS	US	ER	FEIT	Disorg (F)	SAPS SANS	Inpatient	67	27	40	41.29 (8.55)	Spectrum	DSM-4
Cohen	2006	CS	US	ER	FEIT	Disorg (F)	BPRS	Inpatient	28	24	4	33.36 (1.26)	Scz	DSM-4
Comparelli	2013	CS	Italy	ER	FER	Disorg (F)	PANSS	Mixed	79	46	33	30.59 (5.45)	Spectrum	DSM-4-TR
Comparelli	2012	CS	Italy	ER	FAR	Disorg (F)	PANSS	Mixed	79	46	33	30.05 (1.4)	Spectrum	DSM-4
Corcoran	2005	CS	UK	TOM	Hint	TD	PSE	Outpatient	59	51	8	40.5 (10.1)	Scz	DSM-4
Corcoran	1995	CS	UK	TOM	Hint	TD	PSE	Mixed	55	38	17	31.8 (8.9)	Scz	DSM-3-R
Corrigan	1996	CS	US	SP	SFRT SCRT	Disorg (F)	BPRS	Inpatient	23	17	6	34.5 (6.9)	Spectrum	DSM-3-R
Corrigan	1995	LONG	US	SP	SCRT	Disorg (F)	BPRS	Mixed	40	18	22	35.3 (10.1)	Spectrum	DSM-3-R
Corrigan	1994a	CS	US	SP	SCRT	Disorg (F)	BPRS	Inpatient	26	19	7	34.5 (6.9)	Scz	DSM-3-R
Corrigan	1994b	CS	US	SP	SCRT	Disorg (F)	BPRS	Inpatient Outpatient	23 20	18 9	5 11	33.9 (7.5) 37.4 (8.2)	Scz	DSM-3-R
Docherty	2013	CS	US	SP TOM ER	PONS Cartoon-S Hint Ekman BLERT	CD	CDI	Outpatient	63	42	21	40 (8)	Spectrum	DSM-4
Donohoe	2012	CS	Ireland	TOM	Hint	Disorg (F)	SAPS SANS	Mixed	487	352	135	41.1 (12.31)	Scz	DSM-4
Fett	2013	CS	Netherlands	ER TOM	DFAR Hint	Disorg (F)	PANSS	Mixed	1032	795	237	27.3 (7.2)	Scz	DSM-4-TR
Fiszdon	2013	CS	US	ER PROC TOM	BLERT MSCEIT Hint	Disorg (F)	PANSS	Outpatient	119	77	42	44.95 (11.04)	Spectrum	DSM-4

Fraguas	2008	CS	Spain	ATT	ASQ	Disorg (F)	PANSS	Outpatient	56	31	13	38.1 (9.7)	Spectrum	ICD-10
Fretland	2015	CS	Norway	TOM	MASC	Disorg (F)	PANSS	Mixed	52	33	19	28.8 (NK)	Spectrum	DSM-4
Frith	1996	CS	UK	TOM	Story	Disorg (F)	PSE	Inpatient	55	36	19	32.3 (9.9)	Scz	DSM-3-R
Fullam	2006	CS	UK	ER	AFFECT	Disorg (F)	PANSS	Inpatient	54	54	0	36.11 (8.94)	Scz	DSM-4
Gaebel	1992	LONG	Germany	ER	Ekman	Alogia	SANS	Inpatient	23	17	6	31.3	Scz	DSM-3-R
Gold	2012	CS	US	ER	AER	Disorg (F)	PANSS	Mixed	92	79	13	37.8 (10.4)	Spectrum	DSM-4
Greig	2004	CS	US	TOM	Hint	TD Disorg (F)	PANSS SAPS Gorham	Outpatient	128	102	26	NK	Spectrum	DSM-3-R
Hamm	2012	LONG	US	TOM ER	MAS-A BLERT	Disorg (F)	PANSS	Outpatient	49	44	5	50.37 (7.54)	Spectrum	DSM-4
Harrington	2005	CS	New Zealand	TOM	Story PictSeq	Alogia TD	SAPS SANS	Mixed	25	NK	NK	33.5 (7.9)	Spectrum	DSM-4
Henry	2008	CS	Australia	PROC	ERQ	Alogia TD	SAPS SANS	Mixed	41	19	22	37.5 (10.67)	Spectrum	DSM-4
Henry	2007	CS	Australia	PROC	Video	Alogia TD	SAPS SANS	Outpatient	29	13	16	34.65 (9.37)	Spectrum	DSM-4
Hoschel	2001	CS	Germany	ER	Priming	Disorg (F)	SAPS SANS	Inpatient	23	13	10	37 (13)	Scz	DSM-4
Ihnen	1998	CS	US	SP	SCRT	Disorg (F)	BPRS	Outpatient	26	15	11	33.4 (9.7)	Scz	DSM-4
Ito	1998	CS	Japan	SP	RPT	Disorg (F)	BPRS	Mixed	46	28	18	40.5 (8.7)	Scz	DSM-3-R
Janssen	2006	CS	Netherlands	ATT	IPSAQ	Disorg (I) TD	PSE SAPS	Outpatient	23	17	6	31.8 (9.3)	Scz	DSM-3-R
Johnston	2006	CS	Australia	ER	Ekman	Alogia	SAPS SANS	Outpatient	18	9	9	38.8 (10.0)	Scz	ICD-10

Kee	2009	CS	US	PROC	MSCEIT	Alogia TD	SAPS SANS	Outpatient	50	31	19	34.37 (7.69)	Scz	DSM-4
Kee	2003	LONG	US	ER	FEIT VEIT VAPT	Disorg (I)	BPRS	Outpatient	94	63	31	38.7 (9.8)	Spectrum	DSM-4
Kern	2008	CS	US	TOM	TASIT	Alogia TD	SAPS SANS	Outpatient	49	31	28	34.5 (7.8)	Spectrum	DSM-4
Kim	2007	CS	South Korea	ER SP	VirtualReal	Stereotyped Abstract Disorg (I)	PANSS	Inpatient	30	16	14	29.63 (4.98)	Scz	DSM-4
Kim	2005	CS	South Korea	ER SP	VirtualReal	Stereotyped Disorg (I)	PANSS	Inpatient	17	12	5	30.41 (5.36)	Scz	DSM-4
Kohler	2003	CS	US	ER	PERT	Alogia	SAPS SANS	Outpatient	28	19	9	30.3	Spectrum	DSM-4
Kohler	2000	CS	US	ER	ERT	TD Alogia	SAPS SANS	Outpatient	28	20	15	30.6 (9.5)	Scz	DSM-4
Kosmidis	2007	CS	Greece	ER	KAMT EDT	Disorg (F)	PANSS	Mixed	37	23	14	34.06 (7.92)	Scz	DSM-4
Köther	2012	CS	Germany	TOM	Eyes test	TD	PANADSS	Mixed	76	50	26	34.26 (11.41)	Spectrum	DSM-4-TR
Langdon	2002	CS	Australia	TOM	SCT PictSeq	Alogia TD	SAPS SANS	Mixed	25	NK	NK	NK	Spectrum	DSM-4
Langdon	2001	CS	Australia	TOM	PictSeq	TD Alogia	SAPS SANS	Mixed	32	18	14	37.31 (10.74)	Spectrum	DSM-4
Larøi	2010	CS	Belgium	ER	KDEF	Disorg (F)	PANSS	Inpatient	20	11	9	32.9 (10.36)	Scz	DSM-4
Lehmann	2014	CS	Germany	PROC	MET	Disorg (F)	PANSS	Mixed	55	32	23	39.8 (11.9)	Spectrum	DSM-4-TR
Leitman	2005	CS	US	ER	VEIT VEDT FEIT	Disorg (F)	BPRS	Inpatient	43	33	10	39 (12)	Spectrum	DSM-4

					FEDT									
Lysaker	2013	CS	US	TOM ER	MAS-A Eyes test Hint BLERT	Disorg (F)	PANSS	Outpatient	95	82	13	49.36 (8.7)	Spectrum	DSM-4
Lysaker	2011	LONG	US	TOM ER	Eyes test Hint BLERT	Disorg (F)	PANSS	Outpatient	36	33	3	50.39 (8.29)	Spectrum	DSM-4
Loughland	2002	CS	Australia	ER	VScan	Disorg (F)	PANSS	Outpatient	65	43	22	33.6 (8)	Scz	DSM-3-R
Mancuso[2]	2011	CS	US	TOM SP ATT	MSCEIT TASIT FEIT PONS AIHQ	Alogia	SANS	Outpatient	85	76	9	48.5 (8.6)	Spectrum	DSM-4
Marjoram	2005	CS	UK	TOM	Cartoon	Incoherence Poverty	KSS	Mixed	20	12	8	39.8 (11.6)	Scz	DSM-4
Majorek	2009	CS	Germany	TOM	PictSeq	Disorg (F)	PANSS	Mixed	71	50	21	33.6 (9.5)	Scz	DSM-4
Mazza	2001	CS	Italy	TOM	Story	Disorg (F)	SAPS SANS	Outpatient	35	30	5	33.9 (5.8)	Scz	DSM-4
McCleery	2016	LONG	US	PROC SP	MSCEIT RAD	Disorg (F)	BPRS	Outpatient	41	26	15	31.06 (7.43)	Spectrum	DSM-4
Minor	2015	CS	US	TOM ER PROC	SAT-MC Hint BLERT MSCEIT	Disorg (I)	PANSS	Outpatient	67	63	4	50.49 (10.46)	Spectrum	DSM-4-TR
Minor	2014	CS	US	TOM ER PROC	SAT-MC Hint BLERT MSCEIT	Disorg (F)	PANSS	Outpatient	68	44	24	50.50 (10.38)	Spectrum	DSM-4-TR
Nelson	2007	CS	US	ER	FEIT	Disorg (F)	BPRS	Inpatient	100	72	28	38.38 (9.37)	Scz	DSM-4-TR

[2] The data from the socio-cognitive tasks was subjected to an exploratory factor analysis and the resulting factors were interpreted as shown on the table.

Ng	2015	CS	US	TOM	Hint	Disorg (F)	PANSS	Outpatient	193	124	69	46.19 (10.81)	Spectrum	DSM-4
Nienow	2006	CS	US	SP ER	AIPSS BLERT	Disorg (F)	SAPS SANS	Inpatient	56	42	14	41.54 (7.84)	Spectrum	DSM-4
Ntouros	2014	CS	Greece	TOM ER	PESIT[3]	Disorg (F)	PANSS	Outpatient	65	52	13	26.38 (5.42)	Spectrum	DSM-4
Pentaraki	2012	CS	Greece	TOM	Story Eyes test	Disorg (I)	PANSS	Mixed	21	21	0	24.37 (3.82)	Scz	DSM-4-TR
Peyroux	2014	CS	France	ATT	IbT	Disorg (F)	PANSS	Inpatient	38	26	12	37.0 (7.10)	Scz	DSM-4-TR
Pickup	2001	CS	UK	TOM	Story	Disorg (F)	PSE	Mixed	41	29	12	38.2 (12.4)	Scz	DSM-4
Pijnenborg	2009	CS	Netherlands	ER TOM	FEEST PT Fauxpas	Disorg (F)	PANSS	Mixed	46	34	12	27.4 (7.7)	Scz	DSM-4
Piskulic	2011	LONG	Canada	SP ER	SFRT SCRT FEIT FEDT	Stereotyped Abstract	PANSS	Outpatient	103	68	35	30.3 (7.6)	Spectrum	DSM-4
Poole	2000	CS	US	ER	FAR VAR	Disorg (F)	PANSS	Outpatient	40	31	9	41 (9)	Spectrum	DSM-4
Popolo	2016	CS	Italy	TOM	PictSeq Hint	Disorg (F)	PANSS	Outpatient	37	33	4	27.19 (6.57)	Scz	DSM-4-TR
Rassovsky	2011	CS	US	SP	PONS	Alogia	BPRS	Outpatient	174	144	30	44.5 (9.89)	Scz	DSM-4
Renard	2012	CS	US	ER	BLERT	Disorg (F)	PANSS	Outpatient	49	45	4	51.82 (9.75)	Spectrum	DSM-4
Rocca	2016	CS	Italy	PROC ER TOM	MSCEIT FEIT TASIT	Disorg (F)	PANSS	Outpatient	809	568	241	40.1 (10.8)	Scz	DSM-4
Romero-Ferreiro	2016	CS	Spain	ER	FAR	Disorg (F)	PANSS	Outpatient	19	13	6	43.89 (9.5)	Scz	ICD-10

[3] PESIT data on Emotion Recognition and TOM was analyzed separately.

Roncone	2002	CS	Italy	TOM	Story	Disorg (F)	BPRS	Outpatient	44	34	10	33.4 (6.09)	Spectrum	DSM-4
Russell	2006	CS	UK	TOM	Anim	Disorg (F)	PANSS	Mixed	61	59	2	33.89 (9.49)	Spectrum	DSM-4
Sachs	2004	CS	Austria	ER	CPF CPFD EMODIFF PEAT	Alogia	SANS	Inpatient	40	25	15	30.4 (8.1)	Scz	DSM-4
Sarfati	1999a	CS	France	TOM	Cartoon-S	TD	TLC	Inpatient	25	7	18	32.45 (10)	Scz	DSM-4
Sarfati	1999b	CS	France	TOM	Cartoon-S	TD	TLC	Inpatient	26	21	5	32.7 (11.4)	Scz	DSM-3-R
Sarfati	1997a	CS	France	TOM	Cartoon-S	TD	TLC	Inpatient	12	5	7	27.2 (7.5)	Scz	DSM-3-R
Sarfati	1997b	CS	France	TOM	Cartoon-S	TD	TLC	Inpatient	24	19	5	31.9 (11.8)	Scz	DSM-3-R
Schneider	1995	CS	Germany	ER	FDT	Disorg (F) Alogia	SAPS SANS BPRS	Mixed	40	21	19	30.4 (7.7)	Scz	DSM-3-R
Schenkel	2005	CS	US	TOM	Hint	Disorg (F)	BPRS	Inpatient	42	15	17	41.71 (10.5)	Spectrum	DSM-4
Sergi	2007	CS	US	SP ER	IPT PONS VEIT FEIT	Alogia	SANS	Outpatient	100	91	9	49 (7.1)	Spectrum	DSM-4
Shamay-Tsoory	2007	CS	Israel	PROC TOM	IRI CogAffect	Alogia	SANS	Mixed	22	13	9	32.56 (10.83)	Scz	DSM-4
Shean	2009	CS	US	TOM	PictArrang	Disorg (F)	SAPS SANS	Inpatient	54	25	29	35.6 (4.32)	Spectrum	DSM-4
Shean	2005	CS	US	TOM	PictArrang	Disorg (F)	BPRS	Inpatient	73	34	39	39.9 (5.42)	Spectrum	DSM-4
Shur	2008	CS	Israel	TOM	Fauxpas	Alogia	SANS	Mixed	26	17	9	32.58 (10.24)	Scz	DSM-4
Silver	2001	CS	Israel	ER	FEIT FEDT	Alogia	SANS	Inpatient	36	25	11	40.61 (10.72)	Scz	DSM-4

Smith	2014	CS	US	PROC ER	EPT AR FAP	Disorg (F)	SAPS SANS	Outpatient	60	38	22	35.36 (9.07)	Scz	DSM-4
Smith	2012	CS	US	PROC	IRI	Disorg (F)	SAPS SANS	Outpatient	46	30	16	35.2 (8.2)	Scz	DSM-4
Sparks	2010	CS	Australia	TOM	TASIT	Alogia	SANS	Outpatient	30	17	13	45.9 (8.7)	Spectrum	DSM-4
Stratta	2007	CS	Italy	TOM	Cartoon	Disorg (F)	PANSS	Outpatient	20	17	3	38.5 (10.9)	Scz	DSM-3-R
Subotnik	2006	CS	US	SP	SFRT	TD	BIZ	Outpatient	47	35	12	28.6 (6.4)	Spectrum	DSM-4
Tan	2014	CS	Australia	PROC	MSCEIT	TD	TLC	Mixed	58	31	27	43.64 (9.36)	Spectrum	DSM-4
Tang	2016	CS	China	ER	FERT	Disorg (F)	BPRS	Inpatient	94	94	0	47.85 (6.35)	Scz	DSM-4
Toomey	2002	CS	US	SP	PONS	Disorg (F) Disorg (I)	BPRS	Inpatient	28	19	9	34.14 (8.42)	Spectrum	DSM-3-R
Tschacher	2006	CS	Switzerland	TOM	CAUSE	Disorg (F)	PANSS	Mixed	31	24	7	27.7 (7.3)	Spectrum	ICD-10
Tseng	2013	CS	Taiwan	ER	DANVA2	Disorg (F)	PANSS	Outpatient	111	51	60	38.23 (10.13)	Scz	DSM-4
Tso	2012	CS	US	PROC	MSCEIT	TD Alogia	SAPS SANS	Outpatient	26	19	7	43.9 (12.5)	Spectrum	DSM-4
Tsotsi	2015	CS	Greece	ER	FAR	Disorg (F)	PANSS	Outpatient	38	19	19	33.9 (6.7)	Scz	DSM-4
Turetsky	2007	CS	US	ER	Penn	Alogia	SAPS SANS	Mixed	16	12	4	30.5 (6)	Scz	DSM-4
Uhlhas	2006	CS	UK	TOM	Hint Eyes test Story	Disorg (F)	PANSS	Mixed	48	34	6	38.4 (7.6)	Spectrum	DSM-4
Urbach	2013	CS	France	TOM	SCD V-SIR	Disorg (F)	SAPS SANS	Mixed	281	149	57	42.7 (10.15)	Scz	DSM-4
Vaskinn	2009	CS	US	SP	IPT-15	Alogia	SANS	Outpatient	72	61	11	46.7 (9.6)	Spectrum	DSM-4

Ventura	2015	LONG	US	TOM	Anim	Disorg (F)	SAPS SANS	Outpatient	77	60	17	21.47 (3.76)	Spectrum	DSM-4
Vohs	2014	CS	US	TOM ER	MAS-A Eyes test Hint BLERT	Disorg (F)	PANSS	Outpatient	26	21	5	23.81 (3.63)	Spectrum	DSM-4
Weniger	2004	CS	Netherlands	ER	Ekman	Disorg (F)	SAPS SANS	Mixed	45	28	17	34.7 (12)	Scz	DSM-4
Wolfkühler	2012	CS	Germany	ER	Ekman	Disorg (F)	PANSS	Inpatient	60	47	13	32.3 (8.3)	Scz	ICD-10
Woodward	2009	CS	Canada	TOM	Hint	Abstract	PANSS	Mixed	46	NK	NK	33.35 (10.36)	Spectrum	DSM-4
Zalla	2006	CS	France	TOM	PictSeq	Disorg (F)	SAPS SANS	Outpatient	40	21	19	40.7 (9.05)	Scz	DSM-4-TR

CS: Cross-sectional; **LONG**: Longitudinal; **TOM**: Theory-of-mind; **ER**: Emotion Recognition; **SP**: Social Perception; **PROC**: Emotion Processing; **ATT**: Attributional Style; **PictSeq**: Picture Sequencing Task; **PictArrang**: Picture Arrangement subtest and/or Picture Completion subtest (WAIS-R); **Eyes test**: "Reading the mind in the eyes" test; **IFE**: The identification of Facial Emotions Task; **SPT**: Social Perception Test; **BLERT**: Bell-Lysaker Emotion Recognition Task; **Hint**: Hinting Task; **SAT-MC**: Social Attribution Test - Multiple Choice; **MSCEIT**: Mayer-Salovey-Caruso Emotional Intelligence Test; **BORI**: Bell Object Relations Inventory; **APT**: Affective Prosody Test; **Cartoon-F**: Fantie's Cartoon Test; **KAMT**: Kinney's Affect Matching Test; **MSAT**: Mental State Attribution Task; **CATS**: Comprehensive Affect Testing System; **FERT**: Facial Emotion Recognition Task; **FEIT**: Facial Emotion Identification Task; **SFRT**: Situational Feature Recognition Test; **SCRT**: Social Cue Recognition Test; **Cartoon-S**: Sarfati ToM Cartoon Stories Test; **PONS**: Profile of Nonverbal Sensitivity Test; **Ekman**: Ekman stimuli/test; **DFAR**: The Degraded Facial Affect Recognition Task; **ASQ**: Attributional Style Questionnaire; **MASC**: Movie for the Assessment of Social Cognition; **Story**: ToM Stories Task (1st and 2nd order); **IbT:** Intentionality bias Test; **RAD:** Relationships Across Domains test; **AFFECT**: Animated Full Facial Comprehension Test; **AER**: Auditory Emotion Recognition Task; **MAS-A**: Metacognitive Assessment Scale-Abbreviated; **ERQ**: Emotion Regulation Questionnaire; **Video**: Emotion Elicitation using Video Clips; **Priming**: Emotional Priming Task; **RPT**: Role Play Test; **IPSAQ:** Internal, Personal, Situational Attributions Questionnaire; **VEIT**: Voice Emotion Identification Test; **VAPT**: Videotape Affect Perception Test; **TASIT**: The Awareness of Social Inference Test; **VirtualReal**: Virtual Reality Social Perception Tool; **PERT:** Penn Emotion Recognition Test; **ERT**: Emotion Recognition Task; **EDT**: Emotion Discrimination Test; **SCT**: Story Comprehension Task; **KDEF**: Karolinska Directed Emotional Faces; **MET:** Multifaceted Empathy Test; **VEDT**: Voice Emotion Discrimination Test; **FEDT**: Face Emotion Discrimination Test; **VScan**: Visual Scanpaths; **AIHQ**: Ambiguous Intentions Hostility Questionnaire; **Cartoon**: ToM Cartoon Jokes Task; **AIPSS**: Assessment of Interpersonal Problem-Solving Skills; **PESIT**: Perception of Social Inference Test; **FEEST**: The Facial Expression of Emotions: Stimuli and Test; **Fauxpas**: Faux Pas Task; **PT**: Prosody Task; **FAR**: Facial Affect Recognition; **VAR**: Vocal Affect Recognition; **Anim**: Animations Task; **CPF:** Computerised Penn Facial Memory Test; **CPFD:** Computerised Penn Facial Test Delayed; **EMODIFF:** Emotion Differentiation Test; **PEAT:** Penn's Emotion Acuity Test; **FDT**: Facial Discrimination Task; **CAUSE:** Perception of causality paradigm; **DANVA2:** Diagnostic Analysis of Nonverbal Accuracy; **IPT**: Interpersonal Perception Task; **IRI**: Interpersonal Reactivity Index; **CogAffect**: Cognitive and Affective Mental Inference Task adapted from 'The Seeing Leads To Knowing' Test; **EPT**: Emotional Perspective-Taking Task; **AR**: Affective Responsiveness Task; **FAP**: Facial Affect Perception Task; **Penn**: Penn Facial Emotion Stimuli; **SCD**: Scale for the Evaluation of Communication Disorders; **V-SIR**: Versailles-Situational Intention Reading; **Disorg (F): Disorganised factor; Disorg (I)**: Conceptual disorganisation (item); **TD**: Thought Disorder; **Alogia**: Alogia; **CD**: Communication Disturbances; **Stereotyped**: Stereotyped Thinking; **Abstract**: Abstract Thinking; **Incoherence**: Incoherence of Speech; **Poverty**: Poverty of Speech; **PANSS**: Positive and Negative Syndrome Scale; **PANADSS: Positive and Negative and Disorganized Syndrome Scale; BPRS**: Brief Psychiatric Rating Scale; **SANS**: Scale for the Assessment of Negative Symptoms; **Gorham**: Gorham Proverbs Test; **SAPS**: Scale for the Assessment of Positive Symptoms; **PSE**: Present State Examination; **CDI**: Communication Disturbances Index; **KSS**: Krawiecka Standardized Scale for Rating Chronic Psychotic Patients; **TLC**: Scale for the Assessment of Thought, Language and Communication Disorders; **BIZ**: Bizarre-Idiosyncratic Thinking Scale; **Mixed**: Inpatients and Outpatients; **NK**: Not known; **Spectrum**: Psychosis-Spectrum Disorders; **Scz**: Schizophrenia; **DSM**: Diagnostic and Statistical Manual of Mental Disorders (**R**: Revised; **TR**: Text Revision); **ICD**: International Classification of Diseases.

Table 2. Methodological characteristics of the pooled studies.

3.2.1. Covariates

In order to test the stability of ES across time we ran a meta-regression using year of publication as the predicting variable and individual ES as the outcome variable. Overall, year of publication was found to be a significant predictor of the relationship between symptoms and socio-cognitive performance (β= 0.010; SE = 0.003; 95% CI [0.004; 0.016]; z= 3.34; p= 0.0008) suggesting that ES increased over time.

In order to test if the association between symptoms and social cognition was specific to phase of illness (i.e. state-dependent), we compared the strength of the ES across different patient groups. The analysis of studies that have tested inpatients yielded a correlation of -0.359 (k= 31; 95%CI [-0.419; -0.297]; z= -10.514; p< 0.001) with a significant level of heterogeneity (Q[30]= 44.344; p= 0.044; I^2= 32.347; τ^2= 0.012; SE= 0.010; var= 0.000; τ= 0.109). The analysis for studies that tested outpatients yielded a smaller but nevertheless significant correlation, -0.260 (k= 55; 95%CI [-0.307; -0.213]; z= -10.350; p< 0.001) with a significant level of heterogeneity (Q[54]= 120.950; p< 0.001; I^2= 55.354; τ^2= 0.017; SE= 0.007; var= 0.000; τ= 0.132). Finally, the analysis of studies that have tested mixed samples yielded a correlation of -0.353 (k= 37; 95%CI [-0.414; -0.289]; z= -10.121; p< 0.001) with again a significant level of heterogeneity (Q[36]= 122.079; p< 0.001; I^2= 70.511; τ^2= 0.028; SE= 0.014; var= 0.000; τ= 0.168). Comparison between ES revealed that differences were statistically significant (Q[2] = 8.563; p= 0.014) with the ES for studies with both inpatients and mixed samples being significantly higher than ES for studies with outpatients.

Finally, we ran a meta-regression to test the impact of patient's age on the size of the ES between socio-cognitive performance and TD. Overall, age was not found to be a significant predictor of the ES (β= 0.005; SE = 0.003; 95% CI [−0.001; 0.011]; z= 1.80; p= 0.072).

3.2.2. Subgroup analyses by symptom

In order to calculate the ES for different symptom groups, we ran a subgroup analysis using a mixed effects model. The analysis of studies that used disorganisation or cognitive factors derived from scales such as the PANSS and the BPRS yielded a correlation of -0.323 (k= 76; 95%CI [-0.362; -0.282]; z= -14.638; p< 0.001) again with a significant level of heterogeneity (Q[75]= 205.002; p< 0.001; I^2= 63.415; τ^2= 0.021; SE= 0.008; var= 0.000; τ= 0.143).

A subsample of studies considered alogia (or poverty of speech). For these studies the calculation yielded a significant correlation of -0.300 (k= 26; 95% CI [-0.395; -0.198]; z= -5.584; p< 0.001) but again with a significant level of heterogeneity (Q[25]= 72.995; p< 0.001; I^2= 65.751; τ^2= 0.048; SE= 0.023; var= 0.001; τ = 0.219).

Studies that calculated the ES for TD (including single items such as stereotyped thinking, difficulties with abstract thinking or incoherence of speech) yielded a correlation of -0.292 (k= 33; 95% CI [-0.350; -0.232]; z= -9.115; p< 0.001), also with a significant level of statistical heterogeneity (Q[32]= 47.530; p= 0.038; I^2= 32.675; τ^2= 0.011; SE= 0.009; var= 0.000; τ= 0.105).

In order to compare the ES for the different symptom groups (i.e. disorganisation factor, alogia, and TD), we ran a mixed effect analysis which revealed that differences between groups were not statistically significant (Q[2] = 0.758; p= 0.684).

Finally, we calculated the ES just for studies that had used TD-specific measures (e.g. TLC). These studies yielded a correlation of -0.351 (k=9; 95% CI [-0.479; -0.208]; z= -4.623; p< 0.001), this analysis revealed a non-significant level of statistical heterogeneity (Q[8]= 21.924; p= 0.005; I^2= 63.511; τ^2= 0.033; SE= 0.028; var= 0.001; τ= 0.183).

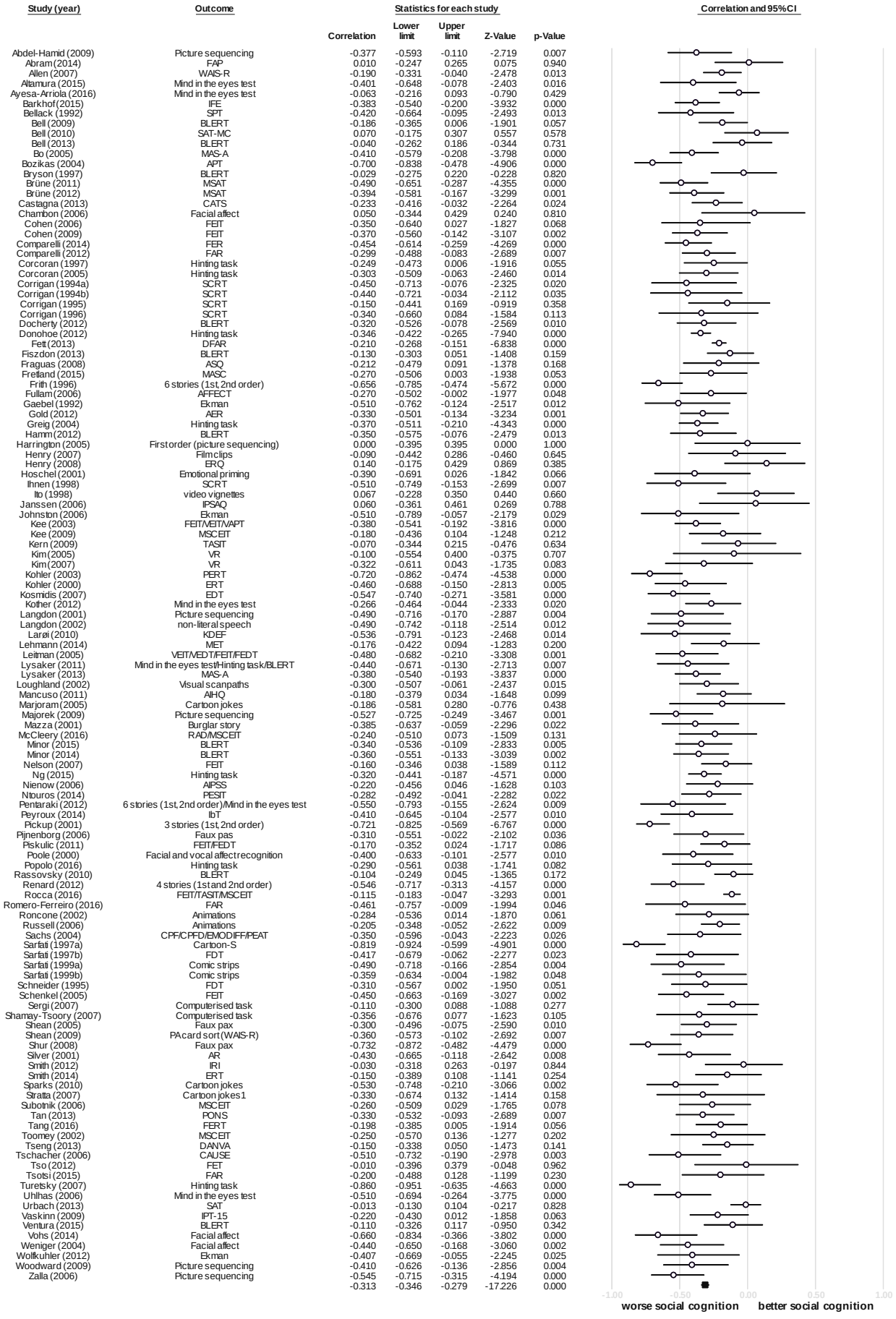


Figure 2. Forest plot.

3.2.3. ToM

The pooled ES for the association between ToM and all symptoms combined was of moderate strength, -0.349 (k= 59; 95% CI [-0.396; -0.301]; z= -13.269; p< 0.001). This association revealed a considerable amount of statistical heterogeneity (Q[58]= 174.594; p< 0.001; I^2= 66.780; τ^2= 0.025; SE= 0.010; var= 0.000; τ= 0.158). We also analysed the data across symptom groups. ES for disorganisation, TD and alogia were all significant and of moderate strength with no significant difference across symptom-group (Supplementary analyses; See Appendix F).

3.2.4. Social perception

The pooled ES for the association between social perception and symptoms was weaker, -0.188 (k= 17; 95%CI [-0.256; -0.117]; z= -5.158; p< 0.001). However, the analysis carried a non-significant amount of heterogeneity (Q[16]= 18.219 ; p= 0.311; I^2= 12.178; τ^2= 0.003; SE= 0.008; var= 0.000; τ = 0.052). The analyses across symptom groups revealed a significant association between social perception and TD (*r*= -0.259), a marginally significant and weak association with alogia, and non-significant ES for the association between social perception and disorganisation (See Appendix F).

3.2.5. Emotion recognition

The relationship between emotion recognition and symptoms was of moderate strength, -0.334 (k= 53; 95%CI [-0.380; -0.286]; z= -12.842; p< 0.001). Again, this analysis revealed that there was a significant amount of statistical heterogeneity across studies (Q[52]= 112.138 ; p< 0.001; I^2= 53.629; τ^2= 0.018; SE= 0.008; var= 0.000; τ= 0.132). The analyses by symptom-group revealed significant and sizable ES for the individual association between

emotion recognition and disorganisation, TD and alogia, especially with the latter (*r*= -0.397), although differences across the three ES were not significant (See Appendix F).

3.2.6. Attributional biases

Only a small number of studies looked at attributional biases and the pooled ES was non-significant, -0.143 (k= 4; 95%CI [-0.347; 0.073]; z= -1.298; p= 0.194). Not surprisingly, this analysis revealed a very low amount of heterogeneity (Q[3]= 5.890; p= 0.117; I^2= 49.067; τ^2= 0.024; SE= 0.040; var= 0.002; τ= 0.154). The analyses by symptom group revealed a significant association only between attributional biases and disorganisation but there were no significant associations for TD or alogia (See Appendix F).

3.2.7. Emotion processing and regulation

The analysis of the strength of association between emotion processing and regulation and symptoms was significant but weak, -0.169 (k= 14; 95%CI [-0.243; -0.092]; z= -4.287; p< 0.001) with a non-significant level of heterogeneity (Q[13]= 14.532; p= 0.337; I^2= 10.540; τ^2= 0.002; SE= 0.009; var= 0.000; τ= 0.048). The analyses by symptom-group revealed significant associations between emotion processing difficulties and both TD and disorganisation but not alogia (See Appendix F; Effect-sizes by socio-cognitive domain; See Appendix F).

3.3. Publication bias

Visual inspection of the scatterplot for the analysis including all of the studies (Funnel plot; See Appendix G) revealed some degree of asymmetry suggestive of publication bias. In order to test the dataset, we used the following tests: (1) Begg and Mazumdar's rank order

correlation; (2) Egger's regression intercept; and, (3) Duval and Tweedie's "trim and fill" procedure.

Begg and Mazumdar's rank correlation [57] yielded a significant Kendall's τ of -0.235 (z= 3.854; p< 0.001) suggestive of publication bias. Consistent with this, the Egger's test [58] also yielded a significant intercept of -1.498 (SE= 0.275; 95% CI [−2.042; -0.955]; t[121]= 5.458; p< 0.001) supporting the existence of bias. Finally, Duval and Tweedie's (2000) "trim and fill" procedure identified 35 potential missing studies (to the right of the mean). The recomputed point estimate, using random effects model, was -0.228 (95% CI [-0.265; -0.191]) suggesting that even after adjustment the estimate was significant and sizable.

4. Discussion

The overall pooled ES suggests a significant and moderate association between poor performance on socio-cognitive tasks and severity of disorganised symptoms in patients diagnosed with psychotic-spectrum disorders. More importantly, sub-analyses by symptom groups showed that correlations were sizable and significant for TD, alogia and disorganised symptoms, with no significant differences between the three symptom groups. However, it is important to point out that we found a considerable amount of statistical heterogeneity. In part, this is not unexpected given the methodological diversity in the assessments of both social cognition (e.g. emotion recognition tasks that tap into different sensory modalities or ToM tasks with different levels of complexity) and symptoms (some studies measured disorganisation with a scale of general psychopathology, e.g. PANSS and others measured TD with specific scales, e.g. TLC). Hence, caution is appropriate when interpreting these findings.

One of the few analyses that did not reveal significant heterogeneity was the relationship between TD and social cognition, especially in the case of the ES calculated for studies that used TD-specific measures. A possible explanation is that these studies used specific symptom measures instead of general psychopathology scales, which often only have limited items to measure cognitive disorganisation or TD (e.g. PANSS or the SAPS) and which may also include non-TD related items. Given that TD is a heterogeneous construct, [29] it is not surprising that heterogeneity was greater when more general psychopathology measures were used. In other words, the more robust the TD measure, the stronger and clearer the overall effect.

Another finding that might speak to the issue of statistical heterogeneity is the association between year of publication and ES. Our meta-regression suggested a linear and significant relationship between these two variables, with ES increasing with time. It is possible that the emergence of dominant theories about the role of social cognition in psychosis has inadvertently led to a publication bias towards "positive" findings in the field. This explanation is consistent with the results of our Begg and Mazumdar's rank correlation and the Egger's test which were consistent with the presence of publication bias, and with the "trim and fill" procedure which identified 35 potentially missing studies. However, recalculation of the point estimate after adjustment for missing studies, revealed an ES that was sizable and significant, so it seems unlikely that missing data would be sufficient to nullify the main findings.

Interestingly, the analysis by age of participants turned out to be non-significant, suggesting that the relationship between social cognition and TD is relatively stable across different age groups. In contrast, the sub-group analyses by patient status revealed that ES were significantly greater in studies that have tested inpatient samples. Although, there is evidence suggesting that both social cognitive difficulties, [60] and TD [20] are not specifically

characteristic of patients diagnosed with schizophrenia (they can be found in other diagnostic groups), it is likely that both TD and poor social cognition become more salient during periods of psychotic crisis when patients are highly distressed. For example, it is a well-established finding that TD worsens when patients are asked to talk about personal and emotionally salient topics, a phenomenon known as the affective reactivity of speech effect. [61,62] It follows that if social cognition is important in TD, then the relationship may well be more evident during an acute inpatient admission.

A second set of analyses concerned the ES across the different socio-cognitive domains. As expected on the basis of socio-cognitive theories of TD and disorganisation, [3,6] a strong association was found between poorer performance on ToM tasks and all symptom groups. We also found an equally sizable and significant association between poor emotion recognition and symptoms. This is not unexpected given that some ToM tasks (e.g. "Reading the mind in the eyes" test) are based on emotion recognition. However, it is interesting to note that most robust association was with alogia. In the case of social perception and emotion processing tasks, although effects were evident, they were much weaker with former being particularly associated with positive forms of TD as opposed to alogia. Regarding the weak associations with emotion processing, this is somehow unexpected given the well-reported finding that TD worsens with negative affect. [61] Finally, the moderate association between attributional biases and disorganisation should be interpreted with caution given that there were only two studies included in the analysis. We are aware of no theoretical model that predicts these patterns of association but it is worth noting that some of these domains do not necessarily have absolute and categorical boundaries and may overlap greatly.

There are good theoretical reasons for expecting a relationship between TD and poor social cognition. As mentioned earlier, Frith [3] suggested that communication difficulties in patients (i.e. TD) could be partly explained by their inability to infer the state of knowledge

of the listener. This is consistent with studies that have found that, when patients with TD are provided with the opportunity to explain their perspective and contextualise their communications, their verbalisations no longer sound bizarre or 'disordered'. [63] Hence, it seems reasonable to propose that difficulties at the level of social cognition (e.g. delayed activation of the fronto-temporal-parietal areas that support mentalisation), [64] may render the patient unable to repair or readjust communication when unprompted, because of difficulties in timely detecting subtle and dynamic emotional and social cues from the interlocutor.

The establishment of conversational alignment, [65] or grounding [66] in communication or dialog is dependent on the early, automatic, and timely processing and monitoring of partner-specific information (e.g. verbal and non-verbal paralinguistic cues and signals). This process helps the addressee disambiguate language and the speaker adjust communication to the needs of the addressee, enabling the incremental shared understanding between interlocutors (as dialog unfolds) and leading to more effective and efficient communication over time. According to Brennan and colleagues:

> "(…) dialog can be viewed as a highly coordinated hypothesis-testing activity that individuals engage in together, where one partner's presentation (their hypothesis of what their partner will understand) plays a dual role by providing the other person with evidence of how the previous utterance has been understood." [66 (p316)]

A person who cannot disambiguate the question of the interviewer, or cannot infer the state of knowledge of the listener, is more likely to answer questions in an egocentric or tangential way, by *intermingling*, interweaving or blending in decontextualised concerns and worries into the context of the conversation, [67] thereby making communications sound idiosyncratic or even bizarre. This account is consistent with findings from studies that have

reported that patients who display TD have significant difficulties disambiguating and processing linguistic and conversational context. [68]

One important point to acknowledge at this stage is that the ability to infer other peoples' mental and emotional states may not be independent from the ability to reflect and understand one's own mental state (i.e. self-reflection or meta-awareness). For example, one study showed that gains in self-reflection predicted improvements in social cognition and, more specifically, the patient's ability to infer the mental or emotional states of others. [69] Some authors have hypothesised that TD patients have difficulties synthesising and making sense of their own cognitive experiences (resulting in "cacophonous selves") [70] and, consistent with this idea, two studies have reported that patients with disorganised symptoms are significantly impaired in both self-reflexivity and social cognition. [71,72] There is also evidence that patients diagnosed with schizophrenia have difficulties recalling autobiographical memories [73] (which may be necessary when making sense of others through analogical reasoning). [74,75] So it is plausible that difficulties with self-reflection or meta-awareness may underlie both poor mentalising and TD. However, the relationship between poor self-reflection and other domains of social cognition also associated with TD would be more difficult to explain.

Another possible interpretation is that symptoms of disorganisation may have a detrimental impact on both the patient's ability to reason about their own and other peoples' mental states. For example, Minor and colleagues reported that symptoms of disorganisation moderated the relationship between neurocognition and both social cognition and self-reflexivity in patients diagnosed with schizophrenia. [76,77] However, such interpretation does not explain why TD patients fail to see their verbalisation as bizarre and idiosyncratic while at the same time they are able to successfully judge the verbalisation of other TD patients as anomalous. [42]

One of the limitations of the present meta-analysis is that the calculated strength of the associations between domains of social cognition and symptoms did not account for symptom comorbidity. This is important because difficulties with ToM have been reported to be significantly associated with negative symptoms and persecutory delusions.[5] In future studies, it will be important to establish the strength of the association between domains of social cognition and TD after accounting for other psychotic experiences especially negative symptoms, given its association with both poor mentalisation and dysfunctional mirror neuron activity. [78] Moreover, it might be suggested that the strength of the ES could just reflect general "severity of illness" or more general cognitive difficulties. However, if this was case, then one would expect the correlations with social perception, emotion regulation and attributional biases to be equally sizable, which they were not. Another limitation of the review is the overrepresentation of men in the study samples. Few studies have attempted to control or account for sex-differences, so it is possible that some of these difficulties are to some extent sex-specific. Moreover, it is important to highlight two important methodological limitations. First, the present qualitative synthesis did not include a second reviewer to test the reliability of the inclusion an exclusion criteria. Second, no quality assessment tool was used to establish the methodological strength of the studies included in the final analysis.

Finally, social cognition is only one piece in the puzzle of TD other psychological mechanisms have been shown to be involved in these cluster of experiences. For example, we have reported previously that difficulties in *internal* source monitoring (ability to correctly discriminate whether self-generated cognitions were verbalised or just thought) [79] coupled with negative affect are important to explain exacerbation of TD during emotional challenge, [61] and that poverty of speech seems to be specifically associated with impoverished inner speech (especially dialogical inner speech). [35] Finally, how these mechanisms relate to

important social predictors of TD remains a matter of speculation. Some authors have suggested that difficulties recognising and reasoning about mental states in patients diagnosed with schizophrenia could be a consequence of early experiences such as poor early attachment relationships, childhood trauma, or isolation, [80] factors that have been found to be associated with TD. [38,81–83] For example, a recent study showed that poor ToM mediated the relationship between insecure attachment and emerging psychotic symptoms. [84] In future studies, it will be important to examine the relationships between social predictors and socio-cognitive processes in TD using more complex psychosocial models.

Contributors

P. Sousa, W. Sellwood, and R. Bentall were responsible for study concept and design. P. Sousa carried out the systematic search, statistical analyses and the interpretation of the findings (under the supervision of W. Sellwood and R. Bentall). P. Sousa was responsible for drafting the manuscript and W. Sellwood, M. Griffiths, and R. Bentall for the critical revision. All authors accepted the final version.

5. References

1. Watzlawick P, Bavelas JB, Jackson DD. *Pragmatics of Human Communication: A Study of Interactional Patterns, Pathologies and Paradoxes*. New York: W. W. Norton & Company; 1967.
2. Corcoran R, Mercer G, Frith CD. Schizophrenia, symptomatology and social inference: investigating "theory of mind" in people with schizophrenia. *Schizophr Res*. 1995;17(1):5-13. http://www.ncbi.nlm.nih.gov/pubmed/8541250.
3. Frith CD. *The Cognitive Neuropsychology of Schizophrenia*. Psychology Press; 1992.

4. Savla GN, Vella L, Armstrong CC, Penn DL, Twamley EW. Deficits in domains of social cognition in schizophrenia: a meta-analysis of the empirical evidence. *Schizophr Bull*. 2013;39:979-992. doi:10.1093/schbul/sbs080.

5. Sprong M, Schothorst P, Vos E, Hox J, van Engeland H. Theory of mind in schizophrenia: meta-analysis. *Br J Psychiatry*. 2007;191:5-13. doi:10.1192/bjp.bp.107.035899.

6. Hardy-Baylé M-C, Sarfati Y, Passerieux C. The cognitive basis of disorganization symptomatology in schizophrenia and its clinical correlates. *Schizophr Bull*. 2003;29(3):459-471.

7. Green MF, Penn DL, Bentall R, et al. Social cognition in schizophrenia: an NIMH workshop on definitions, assessment, and research opportunities. *Schizophr Bull*. 2008;34(6):1211-1220. doi:10.1093/schbul/sbm145.

8. Murray L, Hentges F, Hill J, et al. The effect of cleft lip and palate, and the timing of lip repair on mother-infant interactions and infant development. *J Child Psychol Psychiatry Allied Discip*. 2008;49:115-123. doi:10.1111/j.1469-7610.2007.01833.x.

9. Baron-Cohen S, Wheelwright S, Hill J, Raste Y, Plumb I. The "Reading the Mind in the Eyes" Test revised version: a study with normal adults, and adults with Asperger syndrome or high-functioning autism. *J Child Psychol Psychiatry*. 2001;42:241-251. doi:10.1111/1469-7610.00715.

10. Langdon R, Coltheart M. Mentalising, schizotypy, and schizophrenia. *Cognition*. 1999;71:43-71. doi:10.1016/S0010-0277(99)00018-9.

11. Costanzo M, Archer D. Interpreting the expressive behavior of others: The Interpersonal Perception Task. *J Nonverbal Behav*. 1989;13:225-245. doi:10.1007/BF00990295.

12. Rosenthal JA, DiMatteo MR, Rogers PL, Archer D. *Sensitivity to Nonverbal*

Communication: The PONS Test. Baltimore, MD: Johns Hopkins University Press; 1979.

13. Bryson G, Bell M, Lysaker P. Affect recognition in schizophrenia: A function of global impairment or a specific cognitive deficit. *Psychiatry Res*. 1997;71:105-113. doi:10.1016/S0165-1781(97)00050-4.

14. Kerr SL, Neale JM. Emotion perception in schizophrenia: specific deficit or further evidence of generalized poor performance? *J Abnorm Psychol*. 1993;102:312-318. doi:10.1037/0021-843X.102.2.312.

15. Peterson C, Semmel A, von Baeyer C, Abramson LY, Metalsky GI, Seligman MEP. The attributional Style Questionnaire. *Cognit Ther Res*. 1982;6(3):287-299. doi:10.1007/BF01173577.

16. Kinderman P, Bentall RP. A new measure of causal locus: The internal, personal and situational attributions questionnaire. *Pers Individ Dif*. 1996;20:261-264. doi:10.1016/0191-8869(95)00186-7.

17. Gross JJ, John OP. Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *J Pers Soc Psychol*. 2003;85:348-362. doi:10.1037/0022-3514.85.2.348.

18. Mayer JD, Salovey P, Caruso DR. *Mayer-Salovey-Caruso Emotional Intelligence Test*. North Tonawanda, NY: Multi-Health Systems, Inc.; 1999.

19. Andreasen NC. Should the term "thought disorder" be revised? *Compr Psychiatry*. 1982;23(4):291.

20. Marengo J, Harrow M. Longitudinal courses of thought disorder in schizophrenia and schizoaffective disorder. *Schizophr Bull*. 1997;23:273-285.

21. Tan EJ, Thomas N, Rossell SL. Speech disturbances and quality of life in schizophrenia: Differential impacts on functioning and life satisfaction. *Compr*

Psychiatry. 2014;55:693-698. doi:10.1016/j.comppsych.2013.10.016.

22. Harrow M, Marengo JT. Schizophrenic thought disorder at follow-up: its persistence and prognostic significance. *Schizophr Bull*. 1986;12:373-393.

23. Racenstein JM, Penn D, Harrow M, Schleser R. Thought disorder and psychosocial functioning in schizophrenia: the concurrent and predictive relationships. *J Nerv Ment Dis*. 1999;187:281-289. doi:10.1097/00005053-199905000-00003.

24. Bowie CR, Gupta M, Holshausen K. Disconnected and underproductive speech in schizophrenia: Unique relationships across multiple indicators of social functioning. *Schizophr Res*. 2011;131:152-156. doi:10.1016/j.schres.2011.04.014.

25. Cavelti M, Homan P, Vauth R. The impact of thought disorder on therapeutic alliance and personal recovery in schizophrenia and schizoaffective disorder: An exploratory study. *Psychiatry Res*. 2016;239:92-98. doi:10.1016/j.psychres.2016.02.070.

26. Goldsmith LP, Lewis SW, Dunn G, Bentall RP. Psychological treatments for early psychosis can be beneficial or harmful, depending on the therapeutic alliance: an instrumental variable analysis. *Psychol Med*. 2015;45:2365-2373. doi:10.1017/s003329171500032x.

27. McKenna PJ, Oh TM. *Schizophrenic Speech: Making Sense of Bathroots and Ponds That Fall in Doorways*. Cambridge University Press; 2005.

28. Bentall RP, De Sousa P, Varese F, et al. From adversity to psychosis: Pathways and mechanisms from specific adversities to specific symptoms. *Soc Psychiatry Psychiatr Epidemiol*. 2014;49(7). doi:10.1007/s00127-014-0914-0.

29. Roche E, Creed L, MacMahon D, Brennan D, Clarke M. The Epidemiology and Associated Phenomenology of Formal Thought Disorder: A Systematic Review. *Schizophr Bull*. 2014. doi:10.1093/schbul/sbu129.

30. Andreasen NC, Grove WM. Thought, language, and communication in schizophrenia:

Diagnosis and prognosis. *Schizophr Bull*. 1986;12(3):348.

31. Andreasen NC. Scale for the assessment of thought, language, and communication (TLC). *Schizophr Bull*. 1986;12(3):473-482. http://www.ncbi.nlm.nih.gov/pubmed/3764363.

32. Liddle PF, Ngan ETC, Caissie SL, et al. Thought and Language Index: an instrument for assessing thought and language in schizophrenia. *Br J Psychiatry*. 2002;181(4):326-330.

33. Harvey P, Lenzenweger MF, Keefe RSE, Pogge DL, Serper MR, Mohs RC. Empirical assessment of the factorial structure of clinical symptoms in schizophrenic patients: formal thought disorder. *Psychiatry Res*. 1992;44(2):141-151.

34. Docherty AR, Berenbaum H, Kerns JG. Alogia and formal thought disorder: Differential patterns of verbal fluency task performance. *J Psychiatr Res*. 2011;45(10):1352-1357. doi:10.1016/j.jpsychires.2011.04.004.

35. de Sousa P, Sellwood W, Spray A, Fernyhough C, Bentall RP. Inner Speech and Clarity of Self-Concept in Thought Disorder and Auditory-Verbal Hallucinations. *J Nerv Ment Dis*. October 2016:1. doi:10.1097/NMD.0000000000000584.

36. Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophr Bull*. 1987;13(2):261-276. http://www.ncbi.nlm.nih.gov/pubmed/3616518.

37. Overall JE, Gorham DR. The Brief Psychiatric Rating Scale. *Psychol Rep*. 1962;10(3):799-812. doi:10.2466/pr0.1962.10.3.799.

38. de Sousa P, Spray A, Sellwood W, Bentall RP. "No man is an island". Testing the specific role of social isolation in formal thought disorder. *Psychiatry Res*. September 2015. doi:10.1016/j.psychres.2015.09.010.

39. Grube BS, Bilder RM, Goldman RS. Meta-analysis of symptom factors in

schizophrenia. *Schizophr Res*. 1998;31(2-3):113-120. doi:10.1016/S0920-9964(98)00011-5.

40. Peralta V, Cuesta M, de Leon J. Formal thought disorder in schizophrenia: a factor analytic study. *Compr Psychiatry*. 1992;33(2):105-110.
41. Liddle PF. The symptoms of chronic schizophrenia. A re-examination of the positive-negative dichotomy. *Br J Psychiatry*. 1987;151:145-151. doi:10.1192/bjp.151.2.145.
42. Harrow M, Lanin-Kettering I, Miller JG. Impaired perspective and thought pathology in schizophrenic and psychotic disorders. *Schizophr Bull*. 1989;15:605-623. doi:10.1093/schbul/15.4.605.
43. Pickering MJ, Garrod S. Toward a mechanistic psychology of dialogue. *Behav Brain Sci*. 2004;27:169-190-226. doi:10.1017/S0140525X04000056.
44. Brüne M. "Theory of mind" in schizophrenia: a review of the literature. *Schizophr Bull*. 2005;31:21-42. doi:10.1093/schbul/sbi002.
45. Green MF, Horan WP, Lee J. Social cognition in schizophrenia. *Nat Rev Neurosci*. 2015;16:620-631. doi:10.1038/nrn4005.
46. Toomey R, Schuldberg D, Corrigan P, Green MF. Nonverbal social perception and symptomatology in schizophrenia. *Schizophr Res*. 2002;53(1-2):83-91. doi:10.1016/S0920-9964(01)00177-3.
47. Kee K, Green M, Mintz J, Brekke J. Is Emotion Processing a Predictor of Functional Outcome in Schizophrenia?. *Schizophr bull*. 2003;29(3):487-497. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=paovftf&NEWS=N&AN=01435748-200329030-00011.
48. Stroup DF, Berlin JA, Morton SC, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group. *JAMA*. 2000;283(15):2008-2012.

doi:10.1001/jama.283.15.2008.

49. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ*. 2009;339(jul21 1):b2535-b2535. doi:10.1136/bmj.b2535.

50. Stratta P, Riccardi I, Mirabilio D, Di Tommaso S, Tomassini A, Rossi A. Exploration of irony appreciation in schizophrenia: A replication study on an Italian sample. *Eur Arch Psychiatry Clin Neurosci*. 2007;257(6):337-339. doi:10.1007/s00406-007-0729-z.

51. Bell MD, Corbera S, Johannesen JK, Fiszdon JM, Wexler BE. Social cognitive impairments and negative symptoms in schizophrenia: Are there subtypes with distinct functional correlates? *Schizophr Bull*. 2013;39(1):186-196. doi:10.1093/schbul/sbr125.

52. Sarfati Y, Hardy-Baylé MC, Besche C, Widlöcher D. Attribution of intentions to others in people with schizophrenia: A non- verbal exploration with comic strips. *Schizophr Res*. 1997;25:199-209. doi:10.1016/S0920-9964(97)00025-X.

53. Subotnik KL, Nuechterlein KH, Green MF, et al. Neurocognitive and social cognitive correlates of formal thought disorder in schizophrenia patients. *Schizophr Res*. 2006;85:84-95. doi:10.1016/j.schres.2006.03.007.

54. Kim K, Kim J-J, Kim J, et al. Characteristics of social perception assessed in schizophrenia using virtual reality. *Cyberpsychol Behav*. 2007;10(2):215-219. doi:10.1089/cpb.2006.9966.

55. Kim K, Kim J-J, Kim J, et al. Investigation of social cue perception in schizophrenia using virtual reality. *Annu Rev CyberTherapy Telemed*. 2005;3:135-142. http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2008-04692-021&lang=es&site=ehost-live&scope=site%5Cnhttp://kwang6@bme.hanyang.ac.kr.

56. Chambon V, Baudouin JY, Franck N. The role of configural information in facial

emotion recognition in schizophrenia. *Neuropsychologia*. 2006;44(12):2437-2444. doi:10.1016/j.neuropsychologia.2006.04.008.

57. Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. *Biometrics*. 1994;50:1088-1101. doi:10.2307/2533446.

58. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ*. 1997;315:629-634. doi:10.1136/bmj.316.7129.469.

59. Duval S, Tweedie R. Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*. 2000;56:455-463. doi:10.1111/j.0006-341x.2000.00455.x.

60. McCleery A, Lee J, Fiske AP, et al. Longitudinal stability of social cognition in schizophrenia: A 5-year follow-up of social perception and emotion processing. *Schizophr Res*. 2016;176(2-3):467-472. doi:10.1016/j.schres.2016.07.008.

61. de Sousa P, Sellwood W, Spray A, Bentall RP. The affective reactivity of psychotic speech: The role of internal source monitoring in explaining increased thought disorder under emotional challenge. *Schizophr Res*. 2016;172:189-194. doi:10.1016/j.schres.2016.01.049.

62. Docherty N. Affective reactivity of symptoms as a process discriminator in schizophrenia. *J Nerv Ment Dis*. 1996;184:535-541. doi:10.1097/00005053-199609000-00004.

63. Harrow M, Quinlan DM. *Disordered Thinking and Schizophrenic Psychopathology*. Gardner press; 1985.

64. Pedersen A, Koelkebeck K, Brandt M, et al. Theory of mind in patients with schizophrenia: Is mentalizing delayed? *Schizophr Res*. 2012;137(1-3):224-229. doi:10.1016/j.schres.2012.02.022.

65. Pickering MJ, Garrod S. Alignment as the basis for successful communication. In:

Research on Language and Computation. Vol 4. ; 2006:203-228. doi:10.1007/s11168-006-9004-0.

66. Brennan SE, Galati A, Kuhlen AK. *Two Minds, One Dialog: Coordinating Speaking and Understanding*. Vol 53.; 2010. doi:10.1016/S0079-7421(10)53008-1.

67. Harrow M, Lanin-Kettering I, Prosen M, Miller JG. Disordered thinking in schizophrenia: intermingling and loss of set. *Schizophr Bull*. 1983;9:354-367.

68. Kuperberg GR, McGuire PK, David AS. Reduced sensitivity to linguistic context in schizophrenic thought disorder: evidence from on-line monitoring for words in linguistically anomalous sentences. *J Abnorm Psychol*. 1998;107:423-434. doi:10.1037/0021-843X.107.3.423.

69. Dimaggio G, Lysaker PH, Carcione A, Nicolò G, Semerari A. Know yourself and you shall know the other… to a certain extent: Multiple paths of influence of self-reflection on mindreading. *Conscious Cogn*. 2008;17(3):778-789. doi:10.1016/j.concog.2008.02.005.

70. Lysaker PH, Lysaker JTJT. Schizophrenia and the collapse of the dialogical self: recovery, narrative and psychotherapy. *Psychother Theory, Res Pract Train*. 2001;38:252-261. doi:10.1037//0033-3204.38.3.252.

71. Lysaker Paul H. PH, Gumley A, Brüne M, Vanheule S, Buck KD, Dimaggio G. Deficits in the ability to recognize one's own affects and those of others: Associations with neurocognition, symptoms and sexual trauma among persons with schizophrenia spectrum disorders. *Conscious Cogn*. 2011;20(4):1183-1192. doi:10.1016/j.concog.2010.12.018.

72. Lysaker PH, Gumley A, Luedtke B, et al. Social cognition and metacognition in schizophrenia: evidence of their independence and linkage with outcomes. *Acta Psychiatr Scand*. 2013;127(3):239-247. doi:10.1111/acps.12012.

73. Berna F, Potheegadoo J, Aouadi I, et al. A Meta-Analysis of Autobiographical Memory Studies in Schizophrenia Spectrum Disorder. *Schizophr Bull*. July 2015:sbv099. doi:10.1093/schbul/sbv099.

74. Saxe R, Moran JM, Scholz J, Gabrieli J. Overlapping and non-overlapping brain regions for theory of mind and self reflection in individual subjects. *Soc Cogn Affect Neurosci*. 2006;1(3):229-234. doi:10.1093/scan/nsl034.

75. Corcoran R, Frith CD. Autobiographical memory and theory of mind: evidence of a relationship in schizophrenia. *Psychol Med*. 2003;33(5):897-905. http://www.ncbi.nlm.nih.gov/pubmed/12877404.

76. Minor KS, Lysaker PH. Necessary, but not sufficient: Links between neurocognition, social cognition, and metacognition in schizophrenia are moderated by disorganized symptoms. *Schizophr Res*. 2014;159(1):198-204. doi:10.1016/j.schres.2014.08.005.

77. Minor KS, Marggraf MP, Davis BJ, et al. Conceptual disorganization weakens links in cognitive pathways: Disentangling neurocognition, social cognition, and metacognition in schizophrenia. *Schizophr Res*. 2015;169(1-3):153-158. doi:10.1016/j.schres.2015.09.026.

78. Mehta UM, Thirthalli J, Aneelraj D, Jadhav P, Gangadhar BN, Keshavan MS. Mirror neuron dysfunction in schizophrenia and its functional implications: A systematic review. *Schizophr Res*. 2014;160(1-3):9-19. doi:10.1016/j.schres.2014.10.040.

79. Johnson MK, Hashtroudi S, Lindsay DS. Source monitoring. *Psychol Bull*. 1993;114:3-28. doi:10.1037/0033-2909.114.1.3.

80. Dimaggio G, Popolo R, Salvatore G, Lysaker PH. Mentalizing in schizophrenia is more than just solving theory of mind tasks. *Front Psychol*. 2013;4(FEB). doi:10.3389/fpsyg.2013.00083.

81. Read J, Argyle N. Hallucinations, delusions, and thought disorder among adult

psychiatric inpatients with a history of child abuse. *Psychiatr Serv*. 1999;50(11):1467-1472.

82. Toth SL, Pickreign Stronach E, Rogosch FA, Caplan R, Cicchetti D. Illogical thinking and thought disorder in maltreated children. *J Am Acad Child Adolesc Psychiatry*. 2011;50(7):659-668.

83. Dozier M, Lee SW. Discrepancies between self-and other-report of psychiatric symptomatology: Effects of dismissing attachment strategies. *Dev Psychopathol*. 1995;7(1):217-226.

84. Hart JR, Venta A, Sharp C. Attachment and thought problems in an adolescent inpatient sample: The mediational role of theory of mind. *Compr Psychiatry*. 2017;78:38-47. doi:10.1016/j.comppsych.2017.07.002.

Chapter 2: Empirical paper

Title: **The role of social isolation and social cognition in thought disorder**

Target: Psychiatry Research[4]

Word Count: 4998

[4] Manuscript is currently under review with Psychiatry Research (Psych Res author guidelines; See Appendix I).

ABSTRACT

A better understanding of how social factors relate to the psychological processes in thought disorder (TD) is necessary for the development of effective psychological interventions. 68 participants diagnosed with psychosis (18-65; 47.1% female) were recruited and evaluated on social cognition (Hinting task, HT; and Reading the Mind in the Eyes test, RMET), social isolation (size of social network, frequency, and quality of contact), psychotic symptoms (Positive and Negative Syndrome Scale, PANSS) and TD (Thought, Language and Communication Disorders Scale, TLC). A mediation model was tested with isolation as the predictor, TD as the outcome, and performance on HT and RMET as the mediators. The final model, with adjustment for comorbid symptoms (i.e. delusions, suspiciousness, hallucinations, and negative symptoms), supported full mediation and explained a significant amount of the observed variance (60%). Performance on the HT was a significant mediator of the relationship between social isolation and TD. From the covariates, delusions contributed independently and significantly to TD. The implications of the findings for psychological practice and TD-specific interventions are discussed as well as the limitations of the study. Further avenues for symptom-specific research are discussed, in particular with reference to more complex psychosocial models.

Keywords: Schizophrenia, social cognition, thought disorder, social isolation, theory-of-mind, emotion recognition.

Highlights

- Social isolation was a significant predictor of thought disorder.
- Performance on the hinting task fully mediated the relationship between social isolation and thought disorder.
- Indirect effects remained significant after controlling for comorbid psychotic experiences.
- In the final model, delusional beliefs significantly predicted thought disorder.

1. Introduction

Formal thought disorder (TD) refers to a heterogeneous cluster of cognitive, linguistic, and communication atypicalities that renders speech difficult to follow and at times unintelligible (Andreasen, 1979a, 1979b; Andreasen and Grove, 1986). Amongst the most prevalent forms of TD are *tangentiality* (first example below), in which the speaker replies to a question in a way that is only vaguely related to the topic, and *derailment*, in which the speaker abruptly wanders off onto different and unrelated topics (second example below):

> "[Interviewer: Strike while the iron is hot] It could mean [pause] Hercules! [Interviewer: Could you say more?] I saw the movie, Hercules. [Interviewer: Yes…] and it means don't iron over your hands and don't strike anybody before you cast the first stone" (Marengo, Harrow, Lanin-Kettering, & Wilson, 1986; p. 498).

> "[Interviewer: How are you?] To relate to people about new-found…talk about statistical ideology. Err…I find that it's like starting in respect of ideology, ideals change and ideals present ideology and…new entertainments…new, new attainments. And the more one talks about like, ideal totalitarianism or hotelatarianism, it's like you want new ideas to be formulated, so that everyone can benefit in mankind, so we can all live in our ideal heaven. Presumably, that's what we still want, and with these ideas, it can be brought about, I find the…it's like a rose garden" (Laws, Kondel, & McKenna, 1999; p. 105).

TD is common in patients diagnosed with schizophrenia and psychotic-spectrum disorders but can be observed in other diagnostic groups (McKenna and Oh, 2005; Roche et al., 2014; Yalincetin et al., 2016). For many patients, TD is relatively enduring (Bowie et al.,

2005; Harrow & Marengo, 1986; Marengo & Harrow, 1997). This is problematic since the presence of TD has been associated with poorer work (Racenstein et al., 1999) and social functioning (Bowie, Gupta, & Holshausen, 2011; Bowie & Harvey, 2008; Harrow & Marengo, 1986), poorer quality of life (Tan et al., 2014) and high rates of rehospitalisation (Harrow & Marengo, 1986; Wilcox, 1990). TD has also been found to have a negative impact on clinicians' ratings of the therapeutic alliance (Cavelti et al., 2016) a core process in effective cognitive behavioral therapy for psychosis (CBTp; Goldsmith, Lewis, Dunn, & Bentall, 2015). Moreover, TD has been found to be a significant predictor of future conversion into psychosis in high-risk populations (Bearden, Wu, Caplan, & Cannon, 2011; Cannon et al., 2008; DeVylder et al., 2014; Ott, Roberts, Rock, Allen, & Erlenmeyer-Kimling, 2002). These findings make TD an important area of scientific inquiry and an interesting target for preventative work.

1.1. The role of social cognition in TD

The examples of *derailment* and *tangentiality* highlighted above occurred in a social and conversational context in which the patient showed an apparent failure to recognise that communication had gone awry. Consistent with this, TD patients do not tend to see their own verbalizations as idiosyncratic or difficult to follow, despite being able to successfully identify others' verbalizations as atypical or bizarre (Harrow, Lanin-Kettering, & Miller, 1989). One possible explanation is that these patients may have an impaired 'theory of mind' (ToM or mentalization), the ability to understand the mental states of other people (Frith, 1992; Hardy-Baylé, Sarfati, & Passerieux, 2003). This kind of impairment would make it difficult for the speaker to be aware of the beliefs and intentions of the interlocutor, which is necessary to guide and readjust the discourse to the needs of the listener when

communication has gone awry (Pickering and Garrod, 2004), potentially resulting in communications being experienced by the listener as *tangential* or *derailed*. Early studies that tested social inference through the use of vignettes portraying indirect speech acts (e.g. Corcoran, Mercer, & Frith, 1995), and a later meta-analysis on mentalization in psychosis (Sprong et al., 2007), were both consistent with a link between poor ToM and symptoms of TD and disorganization. For example, the latter review reported a substantial effect-size (ES) when comparing the performance of patients with disorganized symptoms and 'healthy' controls on mentalization tasks (d= –2.23). However, this finding does not establish a specific association between ToM and TD, as the analyses did not account for symptom comorbidity (ESs were also significant for patients without disorganization, paranoia, and in remission). Furthermore, the finding does not establish that ToM specifically is impaired in TD. Hence, Ventura, Wood, and Hellemann (2013) reported moderate ES for the association between both negative and disorganized symptoms and various socio-cognitive domains.

1.2. Intermingling of personal concerns and worries in TD

Harrow and colleagues have suggested that the apparent bizarre and idiosyncratic quality of TD can also be explained by the intermingling into the patient's speech of personal salient concerns and worries that do not fit the 'external' context of the conversation (Harrow, Lanin-Kettering, Prosen, & Miller, 1983; Harrow & Prosen, 1978, 1979). They point out that delusions certainly qualify as personal salient concerns and worries of this kind (Lanin-Kettering and Harrow, 1985) and reported significant associations between delusional beliefs and the presence of TD in patients (Harrow & Quinlan, 1985; Harrow, Silverstein, & Marengo, 1983). These findings were interpreted as supporting the hypothesis that TD patients stray from the 'external' context of the conversation (Harrow et al., 2000) as they

mix in the conversation decontextualized worries and concerns, including delusional ideas (Harrow, Lanin-Kettering, et al., 1983), an effect that seems to be true not only for thought-disordered patients diagnosed with schizophrenia but also for patients diagnosed with other diagnoses (Harrow et al., 2003). This hypothesis is consistent with impaired ToM, as intermingling would be expected to occur when the speaker is unaware of the needs of the listener.

1.3. Social isolation

Other researchers have suggested that social isolation may be an important factor in the development and maintenance of psychotic experiences. For example, Hoffman (2007) suggested that social withdrawal and isolation during critical developmental periods could lead to deafferentation-like effects in the brain regions that support the generation of complex social meaning facilitating psychotic experiences in vulnerable individuals. Freeman and colleagues have suggested that social isolation might be an important factor in the maintenance of persecutory beliefs since it deprives individuals of crucial disconfirmatory feedback from others (Freeman & Garety, 2006; Freeman, 2007; Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002).

Although most of the studies of social isolation and psychosis carried out to date have not focused on specific symptoms, a large corpus of findings has accumulated showing that psychotic patients have higher rates of social isolation (Hirschberg, 1985), loneliness (Michalska da Rocha et al., 2017), smaller social networks (Erickson et al., 1989; Macdonald et al., 2000), fewer confidants (Morgan et al., 2008), and contacts within their networks (Reininghaus et al., 2008). These characteristics predate the onset of psychosis (Gayer-Anderson and Morgan, 2013) and do not seem to represent a ‘network crisis’ in response to

the onset illness. For example, in a longitudinal survey study, Wiles and colleagues (2006) reported that smaller social networks at baseline were a significant predictor of the likelihood of self-reported psychotic experiences 18-months later. Similarly, Malmberg and colleagues (1998) reported that, in a large sample of 50,054 Swedish conscripts, those individuals who had reported having fewer than 2 friends and preferred smaller groups were significantly more likely to have developed psychotic experiences 15-years later. Birth cohort studies have also identified social isolation in childhood as being significantly associated with later diagnosis of schizophrenia (Cannon et al., 2002; Jones, Rodgers, Murray, & Marmot, 1994; Welham, Isohanni, Jones, & McGrath, 2009).

1.4. Social isolation and TD

Very little research has been carried out on social factors specifically associated with the development and maintenance of TD (Bentall et al., 2014). TD has been assumed to be the expression of a discrete neuroanatomical deficit (e.g. *left superior temporal gyrus*; Sumner, Bell, & Rossell, 2018) perhaps originating from genetic vulnerabilities (e.g. $FOXP_2$; Levy et al., 2010). However, it is important to acknowledge that TD occurs in a communicational context and that emotional and social factors are crucial for understanding its development and maintenance. For example, there is a considerable volume of research documenting the impact of stress or arousal of negative affect on TD (de Sousa, Sellwood, Spray, & Bentall, 2016; Docherty, 1996).

We have previously reported a significant and sizable relationship between TD and self-reported social isolation (de Sousa, Spray, Sellwood, & Bentall, 2015). Importantly, this relationship remained significant when we controlled for comorbid psychotic symptoms (i.e. hallucinations, and suspiciousness). Horan and colleagues (2006) have also reported

significant correlations between thought disturbance, in psychotic patients, and smaller social network size (along with other network-related variables). Badcock and colleagues (2015) reported a significant association between subjective ratings of TD in psychotic patients and loneliness and suggested that isolation might contribute to the maintenance of TD by taxing already depleted cognitive and executive resources in patients. We interpreted these findings as suggesting that social isolation may play an important role in both the maintenance and development of TD. In this context, it is important to note that several studies have reported significant relationships between isolation and poorer executive processes, social cognition, and more general cognitive processes in non-psychiatric populations (Cacioppo and Hawkley, 2009). We hypothesized that lack of social interaction (social feedback; Hammer, Makiesky-Barrow, & Gutwirth, 1978) and conversational opportunities could have an impact on the ability of the patient to successfully keep to the 'external' conversational context with others.

1.5. The present study

The preceding review of the literature has highlighted that TD is a social phenomenon, in which failures of conversation alignment occur when the affected individual is preoccupied with salient (possibly delusion-related) thoughts and lacks the social cognitive skills to recognise the listener's failure to follow the conversation. We have suggested that the relevant social cognitive deficits may develop in the context of social isolation. In the present study, we conducted a preliminary test of this model by testing the following hypotheses: (1) TD would be predicted by social isolation after adjustment for comorbid symptoms (negative symptoms, delusions, suspiciousness, and hallucinations); (2) poor performance on social cognitive tasks will be specifically associated with TD; and (3) the statistical effect of social

isolation on TD will be mediated by performance on social cognitive tasks after adjusting for comorbid symptoms. Given the previous finding of Harrow and colleagues that delusions were associated with TD, we also considered this association in our analyses.

2. Methods

2.1. Participants

68 participants were recruited from local mental health services across the North West of England. Participants were originally identified and approached by care coordinators. The recruitment targeted individuals 18-65 years of age, who had a primary diagnosis of a psychotic-spectrum disorder as determined by their responsible clinicians (e.g. schizophrenia, schizoaffective disorder, or unspecified non-organic psychosis, see Table 3). All participants were deemed to have the capacity to consent to take part in research (as assessed by care coordinator, or responsible clinician). Excluded from the study were individuals with a diagnosis of moderate to severe learning disability; neurological or any other organic conditions that could significantly impact on cognitive performance; or who had a diagnosis of substance misuse disorder. All participants were provided with information about the study (Participant information sheet; See Appendix J) and time to decide if they were willing to take part (Participant consent form; See Appendix L). A £10 voucher was offered to all participants as a sign of appreciation for their contribution.

2.2. Measures

2.2.1. Psychotic symptoms

Psychotic symptoms were assessed with the *Positive and Negative Syndrome Scale* (PANSS; Kay, Fiszbein, & Opler, 1987). The PANSS is a 30-item semi-structured clinical interview that requires 45-50 minutes to administer (See Appendix M). The scale is composed of 7 positive (e.g. hallucinatory behaviour or suspiciousness), 7 negative (e.g. blunted affect or emotional withdrawal) and 16 general symptoms (e.g. lack of judgement and insight or poor impulse control). Each item is scored on a severity scale of 1 (absent) to 7 (extreme) with overall scores ranging from 30 to 210 (PANSS rating criteria and form; See Appendix N). The scale has been widely used in both research and clinical settings and has good psychometric properties (Kay et al., 1987).

2.2.2. Thought disorder (TD)

TD was scored with the *Scale for the Assessment of Thought, Language and Communication Disorders* (TLC; Andreasen, 1986). The TLC is a well-established scale that provides definitions and scores for 18 cognitive, linguistic and communicational atypicalities (TLC definitions, and scoring criteria; See Appendix O). The TLC was developed to be applied to speech samples (e.g. clinical interviews). The different items are scored on a scale of severity ranging from 0 to 4 or 0 to 3 (depending on the item). Global ratings are achieved by summing the individual scores. Some items are considered “more pathological” (e.g. derailment or clanging) and others “less pathological” (e.g. loss of goal or blocking) with former scores being multiplied by 2. The scale has been widely used in research and has good psychometric properties (Andreasen, 1979a).

2.2.3. Social isolation

Social isolation was measured with the *Lubben's Social Network Scale - 18* (LSNS; Lubben, 1988). The LSNS is a self-report questionnaire that measures the size, closeness, and frequency of social contacts using 18 items that cover different domains of social networks (See Appendix P). The scores for each question range from 0 to 5 with total scores ranging from 0 to 90 with the higher scores representing higher social integration (we reversed the scores for ease of interpretation). The instrument has good psychometric properties (Lubben and Gironda, 2004) and has been previously used with individuals diagnosed with psychotic-spectrum disorders (de Sousa, Spray, Sellwood, & Bentall, 2015).

2.2.4. Reading the Mind in the Eyes test (RMET)

The RMET (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) is a task that measures the ability to discriminate mental states in others. The task is based on 36 grey-scale edited pictures (plus one extra practice trial) of males (19) and females (17) that only show the eye region of the face (Stimuli; See Appendix Q). In each picture, the participant is presented with 4 mental state terms (e.g. bored, arrogant, flustered, etc.) and ask to choose and circle the word that best describes what the individual in the picture is thinking or feeling (1 target and 3 foil words). The overall score is calculated by adding the number of correct answers and can range from 0 to 36 (Instructions; See Appendix R). The RMET (revised version) has been used extensively in studies with patients diagnosed with schizophrenia (Bora et al., 2009) and has been shown to have good validity and test-retest reliability (Fernández-Abascal et al., 2013; Vellante et al., 2013).

2.2.5. Hinting task

The Hinting task (Corcoran, Mercer, & Frith, 1995) was designed to test the ability to infer intentions from indirect speech acts. The task consists of 10 vignettes depicting everyday social interactions that are read out loud (See Appendix S). Each vignette ends with a character dropping a hint (e.g. Paul has to go to an interview and he's running late. While he is cleaning his shoes, he says to his wife, Jane: "I want to wear that blue shirt but it's very creased."). The participant is then asked to make an inference about what is being implicitly conveyed. If the answer is correct the participant is given a score of 2. If the answer is not correct than a second hint is given (e.g. Paul goes on to say: "It's in the ironing basket."), if the answer is then correct the participant is given a score of 1 or 0 if he fails to infer the implicit communication. Overall scores are calculated by summing up the scores for each vignette and range from 0 to 20. The task has been extensively used in research settings and has been found to have strong psychometric properties (Pinkham et al., 2016).

2.3. Statistical analyses

Power calculation was computed on G*Power 3.1 software (See Appendix T). Means, standard deviations, counts, and percentages for the study variables, as well as t-tests, ANOVA and an exploratory matrix of bivariate correlations, were all computed on IBM SPSS (version 24.0). The latter analysis was carried out to test some of the basic assumptions necessary to test mediation (Baron and Kenny, 1986). The *p*-value of correlations was adjusted with Bonferroni correction to reduce the risk of type I errors (i.e. the cut-off of the *p*-value was set at α=.05/$n_{\{\text{number of comparisons}\}}$). Inter-rater reliability (IRR) for TD scores was estimated with Intra-class correlations (ICC). Mediation analysis was tested using PROCESS macro (version 3.0; Hayes, 2013) with social isolation (X) as the predictor, TD as the

dependent variable (Y), and the Hinting task and RMET as mediators (M). The final model was adjusted for three covariates (delusions, hallucinations, suspiciousness, and negative symptoms) and R^2 was used to measure goodness-of-fit. The significance of indirect effect (95% CI) was tested using bootstrap estimation with 10000 samples (Hayes, 2013).

2.4. Procedure

University review (See Appendix U), sponsorship (See Appendix V) and NHS ethical approval (See Appendix X) were all acquired prior to start of the study.

Participants were initially asked for demographic (e.g. age, marital status, etc.) and clinical information (e.g. current medications and dosages). They were then interviewed with the PANSS (30-45 minutes), which was recorded, with the participants' consent, using a digital voice recorder (Sony ICD-PX312). All the interviews were carried out by the first author (P.S.) who is trained on the PANSS interview and scoring procedure. The interviews were not only used to assess symptoms but also to later code for TD using the TLC (Andreasen, 1986). Following the PANSS, participants were asked to complete the LSNS, the Hinting task and finally the RMET. The whole procedure did not take more than 90 minutes and all participants were offered the possibility of breaks after each task had been completed. A debrief sheet was provided to participants (See Appendix Z).

For the purposes of establishing IRR, first (P.S.) and third authors (A.E.) independently scored ≈10% (7) of the interviews. The coding was preceded by the careful reading of the TLC, relevant papers and by ongoing discussions. For some items, it was not possible to calculate reliability because they were too infrequent (e.g. neologisms, clanging, etc.) for the remaining TLC items Intra-class correlations were all substantial (ICC > .75).

3. Results

3.1. Demographics and clinical variables

Table 3 shows the means, standard deviations, and counts for the main demographic and clinical variables in the study. Our participants were predominantly White British, single and unemployed. There was a significant representation of participants with a diagnosis of 'other psychosis' perhaps reflecting patients under the care of local Early Intervention Services (these teams take a more symptom-focused approach to treatment).

3.2. TD and clinical and demographic variables

There were no significant differences in TD across sexes (t= .678, n.s.), marital status (t= -1.34, n.s.), work status (t= -1.35, n.s.), or diagnostic group (F(3,64)= 2.64, n.s.). TD was also not correlated with age (*r*= .177, n.s.), or years of education (*r*= -.125, n.s.). However, the relationship with medication was significant (chlorpromazine equivalents: *r*= .238, p= .05) with higher levels of TD being associated with higher levels of anti-psychotic medication.

3.3. Relationships amongst variables of interest

Table 4 below shows an exploratory correlation matrix for the primary variables in our study. Importantly, TD was found to correlate significantly with social isolation and both socio-cognitive measures. Social isolation was correlated with the latter measures but not with the negative scale of the PANSS. The strength and significance of these relationships satisfied the basic conditions to test a mediational model.

Variable		Mean (s.d.)/count (%)	Min	Max
Sex	Male	36 (52.9%)		
	Female	32 (47.1%)		
Age		38.4 (13.15)	18	64
Education (years)		11.5 (2.18)	8	18
Marital status	Single	57 (83.8%)		
	Married	10 (14.7%)		
	Divorced	1 (1.5%)		
Employment status	Unemployed	58 (85.3%)		
	Employed	7 (10.3%)		
	Student	2 (2.9%)		
	Other	1 (1.5%)		
Ethnicity	White British	53 (77.9%)		
	Other British	5 (7.4%)		
	White Irish	3 (4.4%)		
	European	3 (4.4%)		
	Arab	2 (2.9%)		
	African	2 (2.9%)		
Diagnosis	Schizophrenia (F20)	27 (39.7%)		
	Schizoaffective (F25)	20 (29.4%)		
	Delusional disorder (F22)	3 (4.4%)		
	Other psychoses (F29)	18 (26.5%)		
Anti-psychotic medication	FGA[1]	23 (33.8%)		
	SGA[2]	45 (66.2%)		
Chlorpromazine equivalents (mgs)		319.7 (282.2)	0	1465
PANSS	Positive (7-49)	20.7 (7.2)	7	35
	Negative (7-49)	17.8 (6.3)	7	39
	General (16-112)	46.5 (9.9)	25	69
	Total (30-210)	84.9 (18.7)	42	132
Thought disorder (TLC)		12.1 (12.8)	0	46
Social isolation (0-90)		63 (17.1)	17	90
Hinting task (0-20)		15.2 (4.8)	1	20
RMET (0 - 36)		21.1 (6.9)	4	33

[1] First generation antipsychotics
[2] Second generation antipsychotics

Table 3. Demographic and clinical variables.

It is also worth noting the substantial correlation between conceptual disorganization (item P2 from the PANSS) and the TD score. Also of relevance is the significant correlation between TD and the PANSS delusions score and the non-significant relationships between both PANSS delusions and PANSS suspiciousness and the socio-cognitive measures (although, the relationship between suspiciousness score and the hinting task was nearly significant, p= .064). The significant relationship between the negative PANSS scale and the socio-cognitive measures has been reported in previous studies (e.g. Ventura et al., 2013).

3.4. Mediation Model

Multiple regression analyses were carried out to test each path of the proposed mediation model with adjustment for scores on hallucinations, delusions, suspiciousness, and negative symptoms. First, we found that social isolation was a strong predictor of TD (B= .302, t(62)= 3.87, p < .001). Second, social isolation was a strong predictor of both performance on the Hinting task (B= -.126, t(62)= -4.32, p < .001) and RMET (B= -.170, t(62)= -3.86, p < .001). Lastly, performance on the Hinting task (B= -1.301, t(60)= -4.23, p < .001), but not RMET (B= -.319, t(60)= -1.57, p = .123), was a significant predictor of TD. Because both a, and one of the b paths (Hinting task) were significant, we tested for mediation using bootstrapping with bias-corrected confidence estimates. The 95% confidence intervals for the indirect effects were estimated with 10000 bootstrapped resamples as recommended in the literature (Hayes, 2013). The results of the analyses confirmed that performance on the Hinting task (B= -1.272 CI= -1.847 to -.623) but not on the RMET (B= -.335, CI= -.716 to .015), mediated the relationship between social isolation and TD. Importantly, of the four covariates, the delusions item remained as a significant and independent predictor of TD (B= 3.776, t(60)= 4.405, p < .001; bootstrapped: 3.765 CI= 2.002 to 5.655).

	1.	2.	3.	4.	5.	6.	7.	8.
1. Hallucinations (P3)								
2. Delusions (P1)	.347**							
3. Suspiciousness (P6)	.237	**.702***						
4. Conceptual disorganization (P2)	.134	**.473***	.274*					
5. Negative symptoms (PANSS)	.377**	.351**	.231	.209				
6. Isolation (LSNS)	-.121	.098	.025	.334**	.201			
7. Hinting task	-.119	-.209	-.226	**-.623***	**-.439***	**-.503***		
8. RMET	-.132	-.187	-.093	**-.424***	**-.395***	**-.474***	**.605***	
9. TD (TLC)	.035	**.450***	.248*	**.894***	.217	**.461***	**-.622***	**-.514***

Note: Values highlighted in **bold** represent significance after Bonferroni correction $p < 0.0014$ (alpha= 1–0.95/36).

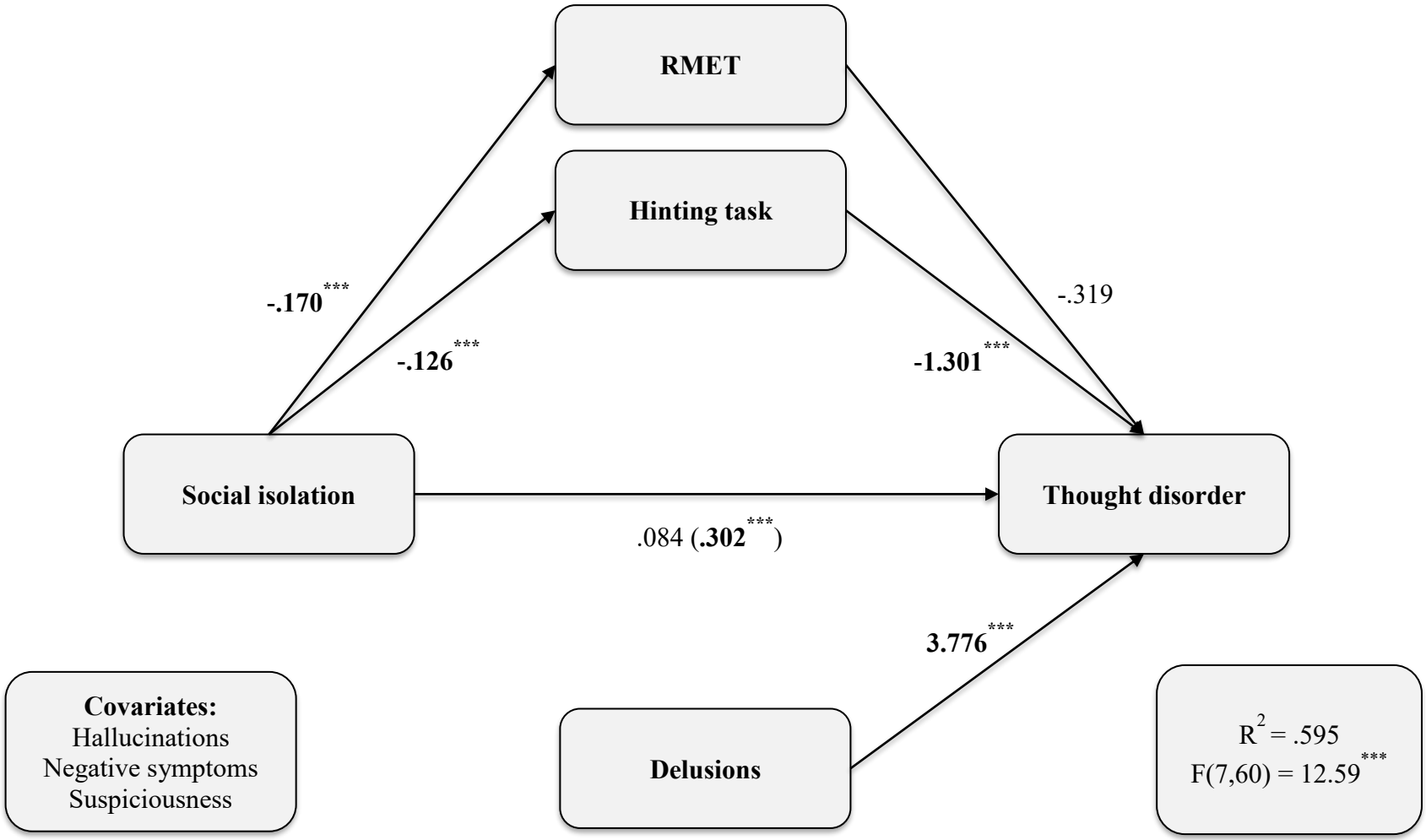
* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Table 4. Bivariate correlations between PANSS symptoms, social isolation, socio-cognitive tasks, and TD.

In addition, the direct effect between social isolation and TD (c'), after adjustment for covariates and mediators, became non-significant supporting full mediation (B= .084, t(60)= 1.103, p = .275). The final model was highly significant and explained 60% of the effect (F(7,60)= 12.588, p < .001). Figure 3 shows the coefficients for the different paths of the mediation model.

4. Discussion

First and foremost, the present study found significant and robust associations between social isolation, poor performance on social cognitive tasks, and TD. The relationship between poor performance on mentalization and TD has been previously investigated (Frith, 1992; Hardy-Baylé et al., 2003; Sprong et al., 2007). However, it is interesting to note that the relationships with both RMET and the Hinting task were substantial and that the correlation between the tasks and both the PANSS delusion and suspiciousness items did not reach significance. The latter point is important because previous studies have reported significant associations between paranoia and ToM performance (Sprong et al., 2007). The relationship between social isolation and TD was more interesting. First, it replicates previous findings from our own and other research groups (Badcock et al., 2015; de Sousa et al., 2015), and second, in contrast to what has previously been suggested (Freeman et al., 2002; Hoffman, 2007) neither hallucinations nor delusions or suspiciousness correlated with social isolation. These findings by themselves suggest some degree of symptom specificity. Also relevant was the significant association between the delusions item and TD, which we will discuss in more detail below.



Note: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Figure 3. Unstandardised coefficients (B) for the different paths in the meditation model (not bootstrapped).

Before addressing our mediation model, it is important to mention the substantial association between RMET and Hinting task. The strength of the association supports the hypothesis that, despite using distinct methodologies (social inference from indirect speech acts as opposed to emotion recognition from facial expressions), both tasks may measure the same construct, as has been suggested in the literature on social cognition in schizophrenia (e.g. Browne et al., 2016). However, the overall goal of the study was to test if the statistical effects of social isolation on TD were mediated by performance on the social cognitive tasks (and if the indirect effects survived the adjustment for comorbid symptoms). Our findings supported a full mediation model, with the relationship between social isolation and TD (path c') losing significance when performance on the social cognitive tasks was entered in the model. This result, along with the strength of the indirect effects in our model, suggests that the relationship between independent and dependent variable was in great part accounted for by the performance of the hinting task, but not so clearly by performance on the RMET. This is interesting given that hinting task could be assumed to target perspective-taking more specifically. Also relevant is that the indirect effects survived the adjustment for comorbid symptoms. This is especially important given that poor performance on social cognition has been previously reported to be associated with negative symptoms in patients diagnosed with schizophrenia (Ventura et al., 2013). In our model, our indirect effects remained highly significant after adjustment for this symptom group, supporting specificity with TD. It is worth mentioning that other TD-focused studies have also reported substantial and specific associations between TD and poor mentalization through the analysis of ToM performance across symptom-contrasted subgroups (e.g. Sarfati, Hardy-Baylé, Besche, & Widlöcher, 1997).

Perhaps more importantly, in our final model the PANSS delusions item remained a robust and independent predictor of TD. This finding is by no means unique, Harrow and

colleagues have reported similar associations between delusions and scores on the bizarre and idiosyncratic thinking (BIT) scale in patients diagnosed with psychotic-spectrum disorders (Harrow et al., 1983; Harrow & Quinlan, 1985; Lanin-Kettering & Harrow, 1985). The authors argued that during communication, TD patients, due to poor perspective taking and heightened arousal (Harrow et al., 1989), tend to intermingle personal concerns and worries, such as delusional beliefs, into their speech making their communications sound bizarre and idiosyncratic (Harrow et al., 1983; Harrow et al., 2003). It follows that during moments of heightened arousal, the ability to mentalize (along with other psychological processes) may become depleted leading to the intrusion of decontextualised concerns and worries (Harrow et al., 1989), and to an unawareness, on the patient's part, that communication has gone awry. Such hypothesis is consistent with our own findings that mentalization and delusional beliefs make independent contributions to TD but also with evidence that TD worsens when patients are asked to talk about emotionally salient topics (de Sousa, Sellwood, Spray, & Bentall, 2016).

On a more speculative level, we would suggest that in TD the ability to model the interlocutor's mind (ToM) may be particularly important when other automatic multi-level priming processes have failed in conversation, and alignment needs to be repaired (Pickering and Garrod, 2004). We would suggest that this may be especially pertinent for instances of tangentiality and derailment where cooperative principles of communication have broken down. In these cases, TD may emerge from a particular difficulty in dynamically and interactively repairing one's communication and meet the communicational needs of the listener. We suggest that TD patients may be particularly vulnerable due to chronic social isolation and lack of exposure to dialogue and social feedback. In this case, social isolation would be both an important predisposing and maintaining factor for TD as suggested by other authors (Badcock et al., 2015). We are not suggesting that social isolation is a sufficient

condition for TD, but rather that social isolation, in combination with other psychological and affective processes (e.g. negative affect; de Sousa, Sellwood, Spray, & Bentall, 2016), may be a necessary condition to increase the likelihood of TD through its impact on social cognition. Chronic social isolation and social withdrawal (ubiquitous in prodromal stages) may have a deleterious effect on socio-cognitive development in psychotic patients. Although our study does not test this hypothesis directly, these ideas are consistent with findings from studies that tested the impact of social isolation on social cognition in non-psychotic participants (Cacioppo and Hawkley, 2009). In future studies, it would be important to test these hypotheses by prospectively testing the cumulative impact of social isolation on both mentalization and TD in patients diagnosed with schizophrenia. Another avenue for research would be to experimentally test the impact of negative affect, or cognitive load, on mentalization and TD.

4.1. Limitations

The present study has methodological, statistical, and conceptual limitations. At a statistical level, the relatively small N limits confidence in the findings. It would be important to replicate the study with a larger N and inclusion of other domains of social cognition (e.g. social perception, and emotion recognition). At a conceptual level, it could be argued that other domains of social cognition, not assessed in this study, may be equally important to understand disordered communication or TD in psychosis. Perhaps, more importantly, is the issue of the interpretation of the direction of effects. In our study, we set our hypotheses and mediation model, theoretically, and we tested its validity by exploring the significance of the indirect effects along with the goodness-of-fit. However, this does not preclude other interpretations. For example, it is possible that increased TD may lead to higher social

isolation (i.e. social distance and avoidance) and poorer performance on social cognition (i.e. poor executive ability). However plausible, this interpretation of the results would not account for other important findings in the field of psychosis. For example, ToM and more generally speaking socio-cognitive difficulties have been shown to be prevalent in individuals at risk of psychosis (Van Donkersgoed et al., 2015) suggesting that these difficulties are present long before the onset of psychosis; the same is true for social isolation (Gayer-Anderson and Morgan, 2013). Children and young people who are later diagnosed with schizophrenia tend to display higher rates of social isolation (see introduction).

4.2. Clinical implications: From the lab to therapy

The findings of the present study have important implications for clinical practice. At one level, they support that social isolation is an important predictor of TD. Therefore, it would be important for current CBTp models of TD (e.g. Palmier-Claus et al., 2017) to incorporate specific strategies to enhance the social networks and conversational opportunities of patients. Another possibility would be to use existing social network interventions (e.g. Terzian et al., 2013) alongside individual CBTp. At another level, we would suggest that difficulties with social cognition could be addressed by complementing therapy with interventions that target poor ToM and mentalization. For example, there is evidence to support the effectiveness of social cognitive training programmes in schizophrenia (e.g. Kurtz et al., 2016). Packages focusing on context appraisal and perspective-taking could be particularly helpful for highly isolated TD patients (e.g. social cognition enhancement training; Choi and Kwon, 2006).

Acknowledgements

The authors would like to thank all the service users that took part in the study and NHS staff for their assistance.

Conflicts of interest

None.

Contributors

P. Sousa, W. Sellwood, and R. Bentall were responsible for study concept and design. P. Sousa collected all the data and carried out the statistical analyses (under the supervision of W. Sellwood and R. Bentall) and along with A. Eldridge coded speech samples. P. Sousa was responsible for drafting the manuscript and W. Sellwood and R. Bentall for the critical revision. All authors accepted the final version.

Role of funding source

This research received no specific grant from any funding agency, commercial or not-for-profit sectors. Financial support was provided through the first author's training budget as part of a Doctorate Training in Clinical Psychology. The funding sponsor had no role in the study design, collection, analysis, or interpretation of data, writing the manuscript, and the decision to submit the manuscript for publication.

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and

with the Helsinki Declaration of 1975, as revised in 2008. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional guides on the care and use of laboratory animals.

References

Andreasen, N.C., 1979a. Thought, language, and communication disorders: I. Clinical assessment, definition of terms, and evaluation of their reliability. Arch Gen Psychiatry 36, 1315-1321.

Andreasen, N.C., 1979b. Thought, language, and communication disorders: II. Diagnostic significance. Arch Gen Psychiatry 36, 1325-1330.

Andreasen, N.C., 1986. Scale for the assessment of thought, language, and communication (TLC). Schizophr Bull 12, 473–482.

Andreasen, N.C., Grove, W.M., 1986. Thought, language, and communication in schizophrenia: Diagnosis and prognosis. Schizophrenia Bulletin 12, 348-359.

Badcock, J.C., Shah, S., Mackinnon, A., Stain, H.J., Galletly, C., Jablensky, A., Morgan, V.A., 2015. Loneliness in psychotic disorders and its association with cognitive function and symptom profile. Schizophrenia Research 169, 268–273.

Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., Plumb, I., 2001. The "reading the mind in the eyes" test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. Journal of Child Psychology and Psychiatry, and Allied Disciplines 42, 241–251.

Baron, R.M., Kenny, D. a, 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology 51, 1173–1182.

Bearden, C.E., Wu, K.N., Caplan, R., Cannon, T.D., 2011. Thought disorder and communication deviance as predictors of outcome in youth at clinical high risk for psychosis. Journal of the American Academy of Child and Adolescent Psychiatry 50, 669–680.

Bentall, R.P., Sousa, P. de, Varese, F., Wickham, S., Sitko, K., Haarmans, M., Read, J., 2014. From adversity to psychosis: Pathways and mechanisms from specific adversities to specific symptoms. Social Psychiatry and Psychiatric Epidemiology 49, 1011–1022.

Bora, E., Yucel, M., Pantelis, C., 2009. Theory of mind impairment in schizophrenia: Meta-analysis. Schizophrenia Research 109, 1-9.

Bowie, C.R., Gupta, M., Holshausen, K., 2011. Disconnected and underproductive speech in Schizophrenia: Unique relationships across multiple indicators of social functioning. Schizophrenia Research 131, 152–156.

Bowie, C.R., Harvey, P., 2008. Communication abnormalities predict functional outcomes in chronic schizophrenia: Differential associations with social and adaptive functions. Schizophrenia Research 103, 240–247.

Bowie, C.R., Tsapelas, I., Friedman, J., Parrella, M., White, L., Harvey, P., 2005. The longitudinal course of thought disorder in geriatric patients with chronic schizophrenia. American Journal of Psychiatry 162, 793–795.

Browne, J., Penn, D.L., Raykov, T., Pinkham, A.E., Kelsven, S., Buck, B., Harvey, P.D., 2016. Social cognition in schizophrenia: Factor structure of emotion processing and theory of mind. Psychiatry Research 242, 150–156.

Cacioppo, J.T., Hawkley, L.C., 2009. Perceived social isolation and cognition. Trends in Cognitive Sciences 13, 447-454.

Cannon, M., Caspi, A., Moffitt, T.E., Harrington, H., Taylor, A., Murray, R.M., Poulton, R., 2002. Evidence for early-childhood, pan-developmental impairment specific to

schizophreniform disorder: Results from a longitudinal birth cohort. Arch Gen Psychiatry 59, 449–456.

Cannon, T.D., Cadenhead, K., Cornblatt, B., Woods, S.W., Addington, J., Walker, E., Seidman, L.J., Perkins, D., Tsuang, M., McGlashan, T., Heinssen, R., 2008. Prediction of psychosis in youth at high clinical risk: A multisite longitudinal study in North America. Archives of General Psychiatry 65, 28–37.

Cavelti, M., Homan, P., Vauth, R., 2016. The impact of thought disorder on therapeutic alliance and personal recovery in schizophrenia and schizoaffective disorder: An exploratory study. Psychiatry Research 239, 92–98.

Choi, K.H., Kwon, J.H., 2006. Social cognition enhancement training for schizophrenia: A preliminary randomized controlled trial. Community Mental Health Journal 42, 177–187.

Corcoran, R., Mercer, G., Frith, C.D., 1995. Schizophrenia, symptomatology and social inference: Investigating "theory of mind" in people with schizophrenia. Schizophrenia Research 17, 5–13.

de Sousa, P., Sellwood, W., Spray, A., Bentall, R.P., 2016. The affective reactivity of psychotic speech: The role of internal source monitoring in explaining increased thought disorder under emotional challenge. Schizophrenia Research 172, 189–194.

de Sousa, P., Spray, A., Sellwood, W., Bentall, R.P., 2015. "No man is an island". Testing the specific role of social isolation in formal thought disorder. Psychiatry Research 230, 304–313.

DeVylder, J.E., Muchomba, F.M., Gill, K.E., Ben-David, S., Walder, D.J., Malaspina, D., Corcoran, C.M., 2014. Symptom trajectories and psychosis onset in a clinical high-risk cohort: The relevance of subthreshold thought disorder. Schizophrenia Research 159, 278–283.

Docherty, N., 1996. Affective reactivity of symptoms as a process discriminator in schizophrenia. Journal of Nervous and Mental Disease 184, 535–541.

Dykens, E., Volkmar, F., Glick, M., 1991. Thought disorder in high-functioning autistic adults. Journal of Autism and Developmental Disorders 21, 291–301.

Erickson, D.H., Beiser, M., Iacono, W.G., Fleming, J.A., Lin, T.Y., 1989. The role of social relationships in the course of first-episode schizophrenia and affective psychosis. American Journal of Psychiatry 146, 1456–1461.

Fernández-Abascal, E.G., Cabello, R., Fernández-Berrocal, P., Baron-Cohen, S., 2013. Test-retest reliability of the "reading the mind in the eyes" test: A one-year follow-up study. Molecular Autism 4, 33-39.

Freeman, D., 2007. Suspicious minds: The psychology of persecutory delusions. Clinical Psychology Review 27, 425–457.

Freeman, D., Garety, P., 2006. Helping patients with paranoid and suspicious thoughts: A cognitive-behavioural approach. Advances in Psychiatric Treatment 12, 404-415.

Freeman, D., Garety, P.A., Kuipers, E., Fowler, D., Bebbington, P.E., 2002. A cognitive model of persecutory delusions. British Journal of Clinical Psychology 41, 331–347.

Frith, C.D., 1992. The cognitive neuropsychology of schizophrenia. Psychology Press, Hove, East Sussex, UK.

Gayer-Anderson, C., Morgan, C., 2013. Social networks, support and early psychosis: a systematic review. Epidemiology and Psychiatric Sciences 22, 131–146.

Goldsmith, L.P., Lewis, S.W., Dunn, G., Bentall, R.P., 2015. Psychological treatments for early psychosis can be beneficial or harmful, depending on the therapeutic alliance: An instrumental variable analysis. Psychological Medicine 45, 2365–2373.

Hammer, M., Makiesky-Barrow, S., Gutwirth, L., 1978. Social networks and schizophrenia. Schizophrenia Bulletin 4, 522–545.

Hardy-Baylé, M.-C., Sarfati, Y., Passerieux, C., 2003. The cognitive basis of disorganization symptomatology in schizophrenia and its clinical correlates. Schizophrenia Bulletin 29, 459–471.

Harrow, M., Green, K.E., Sands, J.R., Jobe, T.H., Goldberg, J.F., Kaplan, K.J., Martin, E.M., 2000. Thought disorder in schizophrenia and mania: Impaired context. Schizophrenia Bulletin 26, 879–891.

Harrow, M., Lanin-Kettering, I., Miller, J.G., 1989. Impaired perspective and thought pathology in schizophrenic and psychotic disorders. Schizophrenia Bulletin 15, 605–623.

Harrow, M., Lanin-Kettering, I., Prosen, M., Miller, J.G., 1983. Disordered thinking in schizophrenia: Intermingling and loss of set. Schizophrenia Bulletin 9, 354–367.

Harrow, M., Marengo, J.T., 1986. Schizophrenic thought disorder at followup: Its persistence and prognostic significance. Schizophrenia Bulletin 12, 373–393.

Harrow, M., Miller, J.G., 1980. Schizophrenic thought disorders and impaired perspective. Journal of Abnormal Psychology 89, 717–727.

Harrow, M., O'Connell, E.M., Herbener, E.S., Altman, A.M., Kaplan, K.J., Jobe, T.H., 2003. Disordered verbalizations in schizophrenia: A speech disturbance or thought disorder? Comprehensive Psychiatry 44, 353–359.

Harrow, M., Prosen, M., 1978. Intermingling and disordered logic as influences on schizophrenic "thought disorders". Archives of General Psychiatry 35, 1213–1218.

Harrow, M., Prosen, M., 1979. Schizophrenic thought disorders: Bizarre associations and intermingling. Am J Psychiatry 136, 293–296.

Harrow, M., Quinlan, D.M., 1985. Disordered thinking and schizophrenic psychopathology. Gardner Press, New York.

Harrow, M., Silverstein, M., Marengo, J., 1983. Disordered thinking: Does it identify nuclear

schizophrenia? Archives of General Psychiatry 40, 765-771.

Hayes, A.F., 2013. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. The Guilford Press, New York.

Hirschberg, W., 1985. Social isolation among schizophrenic outpatients. Social Psychiatry 20, 171–178.

Hoffman, R.E., 2007. A social deafferentation hypothesis for induction of active schizophrenia. Schizophrenia Bulletin 33, 1066–1070.

Horan, W.P., Subotnik, K.L., Snyder, K.S., Nuechterlein, K.H., 2006. Do recent-onset schizophrenia patients experience a “social network crisis”? Psychiatry: Interpersonal and Biological Processes 69, 115–129.

Jones, P., Rodgers, B., Murray, R., Marmot, M., 1994. Child developmental risk-factors for adult schizophrenia in the British 1946 birth cohort. Lancet 344, 1398–1402.

Kay, S.R., Fiszbein, A., Opler, L.A., 1987. The positive and negative syndrome scale (PANSS) for Schizophrenia. Schizophr Bull 13, 261–276.

Kircher, T., Bröhl, H., Meier, F., Engelen, J., 2018. Formal thought disorders: From phenomenology to neurobiology. Lancet Psychiatry 5, 515-526.

Kurtz, M.M., Gagen, E., Rocha, N.B.F., Machado, S., Penn, D.L., 2016. Comprehensive treatments for social cognitive deficits in schizophrenia: A critical review and effect-size analysis of controlled studies. Clinical Psychology Review 43, 80–89.

Lanin-Kettering, I., Harrow, M., 1985. The thought behind the words: A view of schizophrenic speech and thinking disorders. Schizophrenia Bulletin 11, 1–15.

Laws, K.R., Kondel, T.K., McKenna, P.J., 1999. A receptive language deficit in schizophrenic thought disorder: Evidence for impaired semantic access and monitoring. Cognitive Neuropsychiatry 4, 89–105.

Levy, D.L., Coleman, M.J., Sung, H., Ji, F., Matthysse, S., Mendell, N.R., Titone, D., 2010.

The genetic basis of thought disorder and language and communication disturbances in schizophrenia. J Neurolinguistics 23, 176-192.

Lubben, J., 1988. Assessing social networks among elderly populations. Family and Community Health 11, 42-52.

Lubben, J., Gironda, M., 2004. Measuring social networks and assessing their benefits. In: Phillipson, C., Allan, G., Morgan, D. (Eds.), Social networks and social exclusion: Sociological and policy perspectives. Ashgate Publishing Limited, Hampshire, UK, pp. 20–35.

Macdonald, E.M., Hayes, R.L., Baglioni, A.J., 2000. The quantity and quality of the social networks of young people with early psychosis compared with closely matched controls. Schizophrenia Research 46, 25–30.

Malmberg, A., Lewis, G., David, A., Allebeck, P., 1998. Premorbid adjustment and personality in people with schizophrenia. British Journal of Psychiatry 172, 308–313.

Marengo, J., Harrow, M., 1997. Longitudinal courses of thought disorder in schizophrenia and schizoaffective disorder. Schizophrenia Bulletin 23, 273–285.

Marengo, J., Harrow, M., Lanin-Kettering, I., Wilson, A., 1986. Evaluating bizarre-idiosyncratic thinking: A comprehensive index of positive thought disorder. Schizophrenia Bulletin 12, 497-511.

McKenna, P.J., Oh, T.M., 2005. Schizophrenic speech: Making sense of bathroots and ponds that fall in doorways. Cambridge University Press, New York.

Michalska da Rocha, B., Rhodes, S., Vasilopoulou, E., Hutton, P., 2017. Loneliness in psychosis: A meta-analytical review. Schizophrenia Bulletin 44, 114-125.

Morgan, C., Kirkbride, J., Hutchinson, G., Craig, T., Morgan, K., Dazzan, P., Boydell, J., Doody, G.A., Jones, P.B., Murray, R.M., Leff, J., Fearon, P., 2008. Cumulative social disadvantage, ethnicity and first-episode psychosis: A case-control study. Psychological

Medicine 38, 1701–1715.

Ott, S.L., Roberts, S., Rock, D., Allen, J., Erlenmeyer-Kimling, L., 2002. Positive and negative thought disorder and psychopathology in childhood among subjects with adulthood schizophrenia. Schizophrenia Research 58, 231–239.

Palmier-Claus, J., Griffiths, R., Murphy, E., Parker, S., Longden, E., Bowe, S., Steele, A., French, P., Morrison, A., Tai, S., 2017. Cognitive behavioural therapy for thought disorder in psychosis. Psychosis: Psychological, social and integrative approaches 9, 347-357.

Pickering, M.J., Garrod, S., 2004. Toward a mechanistic psychology of dialogue. Behavioral and Brain Sciences 27, 169-190.

Pinkham, A.E., Penn, D.L., Green, M.F., Harvey, P.D., 2016. Social cognition psychometric evaluation: Results of the initial psychometric study. Schizophrenia Bulletin 42, 494–504.

Racenstein, J.M., Penn, D., Harrow, M., Schleser, R., 1999. Thought disorder and psychosocial functioning in schizophrenia: The concurrent and predictive relationships. Journal of Nervous and Mental Disease 187, 281–289.

Reininghaus, U.A., Morgan, C., Simpson, J., Dazzan, P., Morgan, K., Doody, G.A., Bhugra, D., Leff, J., Jones, P., Murray, R., Fearon, P., Craig, T.K.J., 2008. Unemployment, social isolation, achievement-expectation mismatch and psychosis: Findings from the ÆSOP Study. Social Psychiatry and Psychiatric Epidemiology 43, 743–751.

Roche, E., Creed, L., MacMahon, D., Brennan, D., Clarke, M., 2014. The epidemiology and associated phenomenology of formal thought disorder: A systematic review. Schizophrenia Bulletin 41, 951-962.

Sarfati, Y., Hardy-Baylé, M.C., Besche, C., Widlöcher, D., 1997. Attribution of intentions to others in people with schizophrenia: A non-verbal exploration with comic strips.

Schizophrenia Research 25, 199–209.

Sprong, M., Schothorst, P., Vos, E., Hox, J., van Engeland, H., 2007. Theory of mind in schizophrenia: Meta-analysis. British Journal of Psychiatry 191, 5–13.

Sumner, P.J., Bell, I.H., Rossell, S.L., 2018. A systematic review of the structural neuroimaging correlates of thought disorder. Neuroscience and Biobehavioral Reviews 84, 299-315.

Tan, E.J., Thomas, N., Rossell, S.L., 2014. Speech disturbances and quality of life in Schizophrenia: Differential impacts on functioning and life satisfaction. Comprehensive Psychiatry 55, 693–698.

Terzian, E., Tognoni, G., Bracco, R., De Ruggieri, E., Ficociello, R.A., Mezzina, R., Pillo, G., 2013. Social network intervention in patients with Schizophrenia and marked social withdrawal: A randomized controlled study. Canadian Journal of Psychiatry 58, 622–631.

Van Donkersgoed, R.J.M., Wunderink, L., Nieboer, R., Aleman, A., Pijnenborg, G.H.M., 2015. Social cognition in individuals at ultra-high risk for psychosis: A meta-analysis. PLoS ONE 10, 1-16.

Vellante, M., Baron-Cohen, S., Melis, M., Marrone, M., Petretto, D.R., Masala, C., Preti, A., 2013. The “reading the mind in the eyes” test: Systematic review of psychometric properties and a validation study in Italy. Cognitive Neuropsychiatry 18, 326–354.

Ventura, J., Wood, R.C., Hellemann, G.S., 2013. Symptom domains and neurocognitive functioning can help differentiate social cognitive processes in Schizophrenia: A meta-analysis. Schizophrenia Bulletin 39, 102–111.

Welham, J., Isohanni, M., Jones, P., McGrath, J., 2009. The antecedents of Schizophrenia: A review of birth cohort studies. Schizophrenia Bulletin 35, 603–623.

Wilcox, J.A., 1990. Thought disorder and relapse in Schizophrenia. Psychopathology 23,

153–156.

Wiles, N.J., Zammit, S., Bebbington, P., Singleton, N., Meltzer, H., Lewis, G., 2006. Self-reported psychotic symptoms in the general population: Results from the longitudinal study of the British National Psychiatric Morbidity Survey. Br J Psychiatry 188, 519–526.

Yalincetin, B., Bora, E., Binbay, T., Ulas, H., Akdede, B.B., Alptekin, K., 2016. Formal thought disorder in Schizophrenia and Bipolar disorder: A systematic review and meta-analysis. Schizophrenia Research 185, 2–8.

Appendices

Appendix A. BJP author guidelines

Guidelines for review articles

Title: Brief and relevant.

Abstract: Structured (250 words) with the following headings: Background; Aims; Method; Results; Conclusions; Declaration of interest. Abstract should include effect-sizes.

Key words: Not specified.

Text: Introduction, Methods, Results, and Discussion. Discussion section must include limitations and the use of subheadings is encouraged.

Word limit: Flexible for reviews (without tables, figures, or references).

Acknowledgements: Placed before references.

Conflict of interest: Submitted through the online system.

Contributors: Identification of the role of all the co-authors in the study must be place at the end of the manuscript before the references.

Role of the funding source: Identification of sources of funding support. Submitted through the online system.

Ethical statement: Not needed for reviews.

Reference style: Numbered in the order they appear in the text. List of references should follow Vancouver style with the name of the authors and initials appearing after reference numbers.

Meta-analyses: Must adhere to guidelines (e.g. PRISMA, MOOSE, etc.).

Tables and Figures: Maximum 4 (accepts online supplement data).

Appendix B. Socio-cognitive domains and tasks

Socio-cognitive domain	Description	Tool/task	Description
ToM or mental state attribution	Ability to infer intentions, dispositions and beliefs in others from their speech, actions and non-verbal behaviour.	e.g. Hinting task	10 short stories, describing day-to-day social interactions, are read to the individual who is then asked to infer the intentions of different characters from hints or indirect speech acts.
Social perception	Ability to identify, decode and interpret different social cues (verbal and non-verbal), social roles and rules in an interpersonal situation.	e.g. Interpersonal Perception Task	The individual is presented scenes of social interactions (e.g. intimacy, competition, etc.) followed by multiple-choice questions that test the ability to interpret cues about social roles and rules.
Emotion recognition	Ability to identify human emotion from a range of stimuli and cues such as facial expressions or voice (emotional prosody).	e.g. Bell-Lysaker Emotion Recognition Task.	The individual is asked to identify different emotions from 10-second video clips of an actor performing facial, vocal-tonal and upper-body movement cues.
Attributional bias or style	Ability to make quick inferences/attributions about negative or positive events. These inferences can be categorised as external (i.e. the cause of the event is attributed to other people), internal (i.e. cause of the event is attributed to self) or situational (i.e. cause is attributed to	e.g. Internal, Personal, and Situational	Individual is asked to imagine herself in positive and negative social situations and to report the most likely causal

	situational factors).	Attributions Questionnaire.	explanation.
Emotion processing or regulation	Ability to perceive, identify, understand and manage (regulate) emotions in social situation.	e.g. Mayer-Salovey-Caruso Emotional Intelligence Test.	Individual is asked to rate brief vignettes that tap on emotional management, regulation or facilitation.

Table – Socio-cognitive domains and tasks.

Appendix C. PRISMA checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Yes
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Yes
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Yes
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Yes
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	No
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Yes
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Yes
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Yes
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Yes

Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Yes
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Yes
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Yes
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Yes
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Yes

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Yes
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Yes
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Yes
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Yes
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Yes
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Yes
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Yes
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Yes
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Yes

DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Yes
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Yes
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Yes
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Yes

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Appendix D. Information about coding and data extraction.

In order to carry out sensitivity analyses, all pooled studies were coded on the following criteria:

(1) Study ID; (2) Year of publication; (3) Country of origin; (4) Study design (crossectional or longitudinal); (5) Sample size; (6) Number of males; (7) Number of females; (8) Age (mean and s.d.); (9) Level of education; (10) IQ accounted for (Yes or No); (11) Patient status (inpatient, outpatient, or mixed); (12) Control group (for case control studies); (13) Socio-cognitive domain tested (e.g. ToM, Social perception, etc.); (14) Socio-cognitive tests (e.g. Hinting task, SAT, etc.); (15) Symptom measure (e.g. PANSS, TLC, etc.); (16) Diagnostic labels represented (Schizophrenia, Schizoaffective disorder, other psychosis or mixed); (17) Diagnostic criteria (ICD, DSM-III-R or above, or none reported).

In the large majority of the pooled studies bivariate correlations, sample sizes and p-values were available for extraction. In these cases, effect-size was calculated with this data. In a small minority of the pooled studies, correlations, confidence intervals and p-values were estimated from sample size, t-value and p-values (e.g. case control studies with a TD and non-TD group) using the Comprehensive Meta-Analysis software. The first author (P.S) carried out the data extraction.

Appendix E. List of studies included in the meta-analysis

1. Abdel-Hamid M, Lehmkämper C, Sonntag C, Juckel G, Daum I, Brüne M. Theory of mind in schizophrenia: the role of clinical symptomatology and neurocognition in understanding other people's thoughts and intentions. *Psychiatry Res*. 2009;165(1-2):19-26. doi:10.1016/j.psychres.2007.10.021.
2. Abram S V., Karpouzian TM, Reilly JL, Derntl B, Habel U, Smith MJ. Accurate perception of negative emotions predicts functional capacity in schizophrenia. *Psychiatry Res*. 2014;216(1):6-11. doi:10.1016/j.psychres.2014.01.032.
3. Allen DN, Strauss GP, Donohue B, van Kammen DP. Factor analytic support for social cognition as a separable cognitive domain in schizophrenia. *Schizophr Res*. 2007;93(1-3):325-333. doi:10.1016/j.schres.2007.02.008.
4. Altamura AC, Caletti E, Paoli RA, et al. Correlation between neuropsychological and social cognition measures and symptom dimensions in schizophrenic patients. *Psychiatry Res*. 2015;230(2):172-180. doi:10.1016/j.psychres.2015.08.034.
5. Ayesa-Arriola R, Setién-Suero E, Neergaard KD, et al. Evidence for trait related theory of mind impairment in first episode psychosis patients and its relationship with processing speed: A 3 year follow-up study. *Front Psychol*. 2016;7(MAY):1-8. doi:10.3389/fpsyg.2016.00592.
6. Barkhof E, De Sonneville LMJ, Meijer CJ, De Haan L. Processing of facial and nonsocial information is differentially associated with severity of symptoms in patients with multiepisode schizophrenia. *J Nerv Ment Dis*. 2015;203(2):112-119. doi:10.1097/NMD.0000000000000246.
7. Bellack AS, Mueser KT, Wade J, Sayers S, Morrison RL. The ability of schizophrenics to perceive and cope with negative affect. *Br J Psychiatry*. 1992;160(APR.):473-480. doi:10.1192/bjp.160.4.473.
8. Bell MD, Corbera S, Johannesen JK, Fiszdon JM, Wexler BE. Social cognitive impairments and negative symptoms in schizophrenia: Are there subtypes with distinct functional correlates? *Schizophr Bull*. 2013;39(1):186-196. doi:10.1093/schbul/sbr125.
9. Bell MD, Fiszdon JM, Greig TC, Wexler BE. Social attribution test - multiple choice (SAT-MC) in schizophrenia: Comparison with community sample and relationship to neurocognitive, social cognitive and symptom measures. *Schizophr Res*. 2010;122(1-3):164-171. doi:10.1016/j.schres.2010.03.024.

10. Bell M, Tsang HWH, Greig TC, Bryson GJ. Neurocognition, social cognition, perceived social discomfort, and vocational outcomes in schizophrenia. *Schizophr Bull*. 2009;35(4):738-747. doi:10.1093/schbul/sbm169.

11. Bo S, Kongerslev M, Dimaggio G, Lysaker PH, Abu-Akel A. Metacognition and general functioning in patients with schizophrenia and a history of criminal behavior. *Psychiatry Res*. 2015;225(3):247-253. doi:10.1016/j.psychres.2014.12.034.

12. Bozikas VP, Kosmidis MH, Anezoulaki D, Giannakou M, Karavatos A. Relationship of affect recognition with psychopathology and cognitive performance in schizophrenia. *J Int Neuropsychol Soc*. 2004;10(4):549-558. doi:10.1017/S1355617704104074.

13. Bryson G, Bell M, Lysaker P. Affect recognition in schizophrenia: A function of global impairment or a specific cognitive deficit. *Psychiatry Res*. 1997;71:105-113. doi:10.1016/S0165-1781(97)00050-4.

14. Brüne M, Schaub D. Mental state attribution in schizophrenia: What distinguishes patients with " poor" from patients with " fair" mentalising skills? *Eur Psychiatry*. 2012;27(5):358-364. doi:10.1016/j.eurpsy.2010.10.002.

15. Brüne M, Schaub D, Juckel G, Langdon R. Social skills and behavioral problems in schizophrenia: The role of mental state attribution, neurocognition and clinical symptomatology. *Psychiatry Res*. 2011;190(1):9-17. doi:10.1016/j.psychres.2010.03.015.

16. Castagna F, Montemagni C, Maria Milani A, et al. Prosody recognition and audiovisual emotion matching in schizophrenia: The contribution of cognition and psychopathology. *Psychiatry Res*. 2013;205(3):192-198. doi:10.1016/j.psychres.2012.08.038.

17. Chambon V, Baudouin JY, Franck N. The role of configural information in facial emotion recognition in schizophrenia. *Neuropsychologia*. 2006;44(12):2437-2444. doi:10.1016/j.neuropsychologia.2006.04.008.

18. Cohen AS, Nienow TM, Dinzeo TJ, Docherty NM. Attribution biases in schizophrenia: Relationship to clinical and functional impairments. *Psychopathology*. 2009;42(1):40-46. doi:10.1159/000173702.

19. Cohen AS, Forbes CB, Mann MC, Blanchard JJ. Specific cognitive deficits and differential domains of social functioning impairment in schizophrenia. *Schizophr Res*. 2006;81(2-3):227-238. doi:10.1016/j.schres.2005.09.007.

20. Comparelli A, De Carolis A, Corigliano V, et al. Symptom correlates of facial emotion recognition impairment in schizophrenia. *Psychopathology*. 2013;47(1):65-70. doi:10.1159/000350453.

21. Comparelli A, De Carolis A, Corigliano V, et al. Neurocognition, psychopathology, and subjective disturbances in schizophrenia: A comparison between short-term and remitted patients. *Compr Psychiatry*. 2012;53(7):931-939. doi:10.1016/j.comppsych.2012.02.007.

22. Corcoran R, Frith CD. Thematic reasoning and theory of mind . Accounting for social inference difficulties in schizophrenia. *Evol Psychol*. 2005;3:1-19. doi:10.1177/147470490500300101.

23. Corcoran R, Mercer G, Frith CD. Schizophrenia, symptomatology and social inference: Investigating "theory of mind" in people with schizophrenia. *Schizophr Res*. 1995;17:5-13. doi:10.1016/0920-9964(95)00024-G.

24. Corrigan PW, Buican B, Toomey R. Construct validity of two tests of social cognition in schizophrenia. *Psychiatry Res*. 1996;63(1):77-82. http://www.ncbi.nlm.nih.gov/pubmed/8832776.

25. Corrigan PW, Hirschbeck JN, Wolfe M. Memory and vigilance training to improve social perception in schizophrenia. *Schizophr Res*. 1995;17(3):257-265. doi:10.1016/0920-9964(95)00008-9.

26. Corrigan PW, Green MF, Toomey R. Cognitive Correlates To Social Cue Perception in Schizophrenia. *Psychiatry Res*. 1994;53(2):141-151. doi:10.1016/0165-1781(94)90105-8.

27. Corrigan PW. Social cue perception and intelligence in schizophrenia. *Schizophr Res*. 1994;13(1):73-79. doi:10.1016/0920-9964(94)90062-0.

28. Docherty N, McCleery A, Divilbiss M, Schumann EB, Moe A, Shakeel MK. Effects of social cognitive impairment on speech disorder in schizophrenia. *Schizophr Bull*. 2013;39(3):608-616. doi:10.1093/schbul/sbs039.

29. Donohoe G, Duignan A, Hargreaves A, et al. Social cognition in bipolar disorder versus schizophrenia: Comparability in mental state decoding deficits. *Bipolar Disord*. 2012;14(7):743-748. doi:10.1111/bdi.12011.

30. Fett AKJ, Maat A. Social cognitive impairments and psychotic symptoms: What is the nature of their association? *Schizophr Bull*. 2013;39(1):77-85. doi:10.1093/schbul/sbr058.

31. Fiszdon JM, Fanning JR, Johannesen JK, Bell MD. Social cognitive deficits in schizophrenia and their relationship to clinical and functional status. *Psychiatry Res*. 2013;205(1-2):25-29. doi:10.1016/j.psychres.2012.08.041.

32. Fraguas D, Mena A, Franco C, Martín-Blas MM, Nugent K, Rodríguez-Solano JJ. Attributional style, symptomatology and awareness of illness in schizophrenia. *Psychiatry Res*. 2008;158(3):316-323. doi:10.1016/j.psychres.2006.12.002.

33. Fretland RA, Andersson S, Sundet K, Andreassen OA, Melle I, Vaskinn A. Theory of mind in schizophrenia: Error types and associations with symptoms. *Schizophr Res*. 2015;162(1-3):42-46. doi:10.1016/j.schres.2015.01.024.

34. Frith CD, Corcoran R. Exploring "theory of mind" in people with schizophrenia. *Psychol Med*. 1996;26:521-530. doi:10.1017/S0033291700035601.

35. Fullam R, Dolan M. Emotional information processing in violent patients with schizophrenia: Association with psychopathy and symptomatology. *Psychiatry Res*. 2006;141(1):29-37. doi:10.1016/j.psychres.2005.07.013.

36. Gaebel W, Wölwer W. Facial expression and emotional face recognition in schizophrenia and depression. *Eur Arch psychiatry Clin*. 1992:46-52.

37. Gold R, Butler P, Revheim N, et al. Auditory emotion recognition impairments in schizophrenia: Relationship to acoustic features and cognition. *Am J Psychiatry*. 2012;169(4):424-432. doi:10.1176/appi.ajp.2011.11081230.

38. Greig TC, Bryson GJ, Bell MD. Theory of mind performance in schizophrenia: diagnostic, symptom, and neuropsychological correlates. *J Nerv Ment Dis*. 2004;192(1):12-18. doi:10.1097/01.nmd.0000105995.67947.fc.

39. Hamm JA, Renard SB, Fogley RL, et al. Metacognition and Social Cognition in Schizophrenia: Stability and Relationship to Concurrent and Prospective Symptom Assessments. *J Clin Psychol*. 2012;68(12):1303-1312. doi:10.1002/jclp.21906.

40. Harrington L, Langdon R, Siegert RJ, McClure J. Schizophrenia, theory of mind, and persecutory delusions. *Cogn Neuropsychiatry*. 2005;10:87-104. doi:10.1080/13546800344000327.

41. Henry JD, Rendell PG, Green MJ, McDonald S, O'Donnell M. Emotion regulation in schizophrenia: affective, social, and clinical correlates of suppression and reappraisal. *J*

Abnorm Psychol. 2008;117(2):473-478. doi:10.1037/0021-843X.117.2.473.

42. Henry JD, Green MJ, de Lucia A, Restuccia C, McDonald S, O'Donnell M. Emotion dysregulation in schizophrenia: Reduced amplification of emotional expression is associated with emotional blunting. *Schizophr Res*. 2007;95(1-3):197-204. doi:10.1016/j.schres.2007.06.002.

43. Hoschel K, Irle E. Emotional priming of facial affect identification in schizophrenia. *Schizophr Bull*. 2001;27(2):317-327. http://www.ncbi.nlm.nih.gov/pubmed/11354598.

44. Ihnen G, Penn DL, Corrigan PW, Martin J. Social perception and social skill in schizophrenia. *Psychiatry Res*. 1998;80:275-286.

45. Ito M, Shiragata M, Kanno M, Mori Y, Hoshino KY, Niwa SI. Social cue perception in Japanese schizophrenic patients. *Schizophr Res*. 1998;34(1-2):113-119. doi:10.1016/S0920-9964(98)00080-2.

46. Janssen I, Versmissen D, Campo JA, Myin-Germeys I, van Os J, Krabbendam L. Attribution style and psychosis: evidence for an externalizing bias in patients but not in individuals at high risk. *Psychol Med*. 2006;36(6):771-778. doi:10.1017/S0033291706007422.

47. Johnston PJ, Devir H, Karayanidis F. Facial emotion processing in schizophrenia: No evidence for a deficit specific to negative emotions in a differential deficit design. *Psychiatry Res*. 2006;143(1):51-61. doi:10.1016/j.psychres.2005.08.006.

48. Kee KS, Horan WP, Salovey P, et al. Emotional intelligence in schizophrenia. *Schizophr Res*. 2009;107(1):61-68. doi:10.1016/j.schres.2008.08.016.

49. Kee K, Green M, Mintz J, Brekke J. Is Emotion Processing a Predictor of Functional Outcome in Schizophrenia?. *Schizophr bull*. 2003;29(3):487-497. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=paovftf&NEWS=N&AN=01435748-200329030-00011.

50. Kern RS, Green MF, Fiske AP, et al. Theory of mind deficits for processing counterfactual information in persons with chronic schizophrenia. *Psychol Med*. 2008;39(4):645. doi:10.1017/S0033291708003966.

51. Kim K, Kim J-J, Kim J, et al. Characteristics of social perception assessed in schizophrenia using virtual reality. *Cyberpsychol Behav*. 2007;10(2):215-219. doi:10.1089/cpb.2006.9966.

52. Kim K, Kim J-J, Kim J, et al. Investigation of social cue perception in schizophrenia using

virtual reality. *Annu Rev CyberTherapy Telemed*. 2005;3:135-142. http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2008-04692-021&lang=es&site=ehost-live&scope=site%5Cnhttp://kwang6@bme.hanyang.ac.kr.

53. Kohler CG, Turner TH, Bilker WB, et al. Facial Emotion Recognition in Schizophrenia : Intensity Effects and Error Pattern. 2003;(October):1768-1774. doi:10.1176/appi.ajp.160.10.1768.

54. Kohler CG, Bilker W, Hagendoorn M, Gur RE, Gur RC. Emotion recognition deficit in schizophrenia: Association with symptomatology and cognition. *Biol Psychiatry*. 2000;48:127-136. doi:10.1016/S0006-3223(00)00847-7.

55. Kosmidis MH, Bozikas VP, Giannakou M, Anezoulaki D, Fantie BD, Karavatos A. Impaired emotion perception in schizophrenia: A differential deficit. *Psychiatry Res*. 2007;149(1-3):279-284. doi:10.1016/j.psychres.2004.09.011.

56. Köther U, Veckenstedt R, Vitzthum F, et al. "Don't give me that look" - Overconfidence in false mental state perception in schizophrenia. *Psychiatry Res*. 2012;196(1):1-8. doi:10.1016/j.psychres.2012.03.004.

57. Langdon R, Coltheart M, Ward PB, Catts S V. Disturbed communication in schizophrenia: the role of poor pragmatics and poor mind-reading. *Psychol Med*. 2002;32(7):1273-1284.

58. Langdon R, Coltheart M, Ward PB, Catts S V. Mentalising, executive planning and disengagement in schizophrenia. *Cogn Neuropsychiatry*. 2001;6(2):81-108. doi:10.1080/13546800042000061.

59. Larøi F, Fonteneau B, Mourad H, Raballo A. Basic emotion recognition and psychopathology in schizophrenia. *J Nerv Ment Dis*. 2010;198(1):79-81. doi:10.1097/NMD.0b013e3181c84cb0.

60. Lehmann A, Bahçesular K, Brockmann EM, et al. Subjective experience of emotions and emotional empathy in paranoid schizophrenia. *Psychiatry Res*. 2014;220(3):825-833. doi:10.1016/j.psychres.2014.09.009.

61. Leitman DI, Foxe JJ, Butler PD, Saperstein A, Revheim N, Javitt DC. Sensory contributions to impaired prosodic processing in schizophrenia. *Biol Psychiatry*. 2005;58(1):56-61. doi:10.1016/j.biopsych.2005.02.034.

62. Lysaker PH, Gumley A, Luedtke B, et al. Social cognition and metacognition in schizophrenia: evidence of their independence and linkage with outcomes. *Acta Psychiatr Scand*.

2013;127(3):239-247. doi:10.1111/acps.12012.

63. Lysaker PH, Olesek KL, Warman DM, et al. Metacognition in schizophrenia: Correlates and stability of deficits in theory of mind and self-reflectivity. *Psychiatry Res*. 2011;190(1):18-22. doi:10.1016/j.psychres.2010.07.016.

64. Loughland CM, Williams LM, Gordon E. Visual scanpaths to positive and negative facial emotion in an outpatient schizophrenic sample. *Schizophr Res*. 2002;55(2002):159-170.

65. Mancuso F, Horan WP, Kern RS, Green MF. Social cognition in psychosis: Multidimensional structure, clinical correlates, and relationship with functional outcome. *Schizophr Res*. 2011;125:143-151. doi:10.1016/j.schres.2010.11.007.

66. Marjoram D, Tansley H, Miller P, et al. A theory of mind investigation into the appreciation of visual jokes in schizophrenia. *BMC Psychiatry*. 2005;5:12. doi:10.1186/1471-244X-5-12.

67. Majorek K, Wolfkühler W, Küper C, Saimeh N, Juckel G, Brüne M. "Theory of mind" and executive functioning in forensic patients with schizophrenia. *J Forensic Sci*. 2009;54(2):469-473. doi:10.1111/j.1556-4029.2008.00966.x.

68. Mazza M, De Risio a, Surian L, Roncone R, Casacchia M. Selective impairments of theory of mind in people with schizophrenia. *Schizophr Res*. 2001;47(2-3):299-308. http://www.ncbi.nlm.nih.gov/pubmed/11278148.

69. McCleery A, Lee J, Fiske AP, et al. Longitudinal stability of social cognition in schizophrenia: A 5-year follow-up of social perception and emotion processing. *Schizophr Res*. 2016;176(2-3):467-472. doi:10.1016/j.schres.2016.07.008.

70. Minor KS, Marggraf MP, Davis BJ, et al. Conceptual disorganization weakens links in cognitive pathways: Disentangling neurocognition, social cognition, and metacognition in schizophrenia. *Schizophr Res*. 2015;169(1-3):153-158. doi:10.1016/j.schres.2015.09.026.

71. Minor KS, Lysaker PH. Necessary, but not sufficient: Links between neurocognition, social cognition, and metacognition in schizophrenia are moderated by disorganized symptoms. *Schizophr Res*. 2014;159(1):198-204. doi:10.1016/j.schres.2014.08.005.

72. Nelson AL, Combs DR, Penn DL, Basso MR. Subtypes of social perception deficits in schizophrenia. *Schizophr Res*. 2007;94(1-3):139-147. doi:10.1016/j.schres.2007.04.024.

73. Ng R, Fish S, Granholm E. Insight and theory of mind in schizophrenia. *Psychiatry Res*. 2015;225(1-2):169-174. doi:10.1016/j.psychres.2014.11.010.

74. Nienow TM, Docherty NM, Cohen AS, Dinzeo TJ. Attentional dysfunction, social perception, and social competence: what is the nature of the relationship? *J Abnorm Psychol*. 2006;115(3):408-417. doi:10.1037/0021-843X.115.3.408.

75. Ntouros E, Bozikas VP, Andreou C, Kourbetis D, Lavrentiadis G, Garyfallos G. Emotional perception and theory of mind in first episode psychosis: The role of obsessive-compulsive symptomatology. *Psychiatry Res*. 2014;220(1-2):112-117. doi:10.1016/j.psychres.2014.07.058.

76. Pentaraki a D, Stefanis NC, Stahl D, et al. Theory of Mind as a potential trait marker of schizophrenia: a family study. *Cogn Neuropsychiatry*. 2012;17(1):64-89. doi:10.1080/13546805.2011.568289.

77. Peyroux E, Strickland B, Tapiero I, Franck N. The intentionality bias in schizophrenia. *Psychiatry Res*. 2014;219(3):426-430. doi:10.1016/j.psychres.2014.06.034.

78. Pickup GJ, Frith CD. Theory of mind impairments in schizophrenia: symptomatology, severity and specificity. *Psychol Med*. 2001;31(2):207-220. doi:10.1017/S0033291701003385.

79. Pijnenborg GHM, Withaar FK, Evans JJ, van den Bosch RJ, Timmerman ME, Brouwer WH. The predictive value of measures of social cognition for community functioning in schizophrenia: implications for neuropsychological assessment. *J Int Neuropsychol Soc*. 2009;15(2):239-247. doi:10.1017/S1355617709090341.

80. Piskulic D, Addington J. Social cognition and negative symptoms in psychosis. *Psychiatry Res*. 2011;188(2):283-285. doi:10.1016/j.psychres.2011.04.028.

81. Poole JH, Tobias FC, Vinogradov S. The functional relevance of affect recognition errors in schizophrenia. *J Int Neuropsychol Soc*. 2000;6(6):649-658. doi:10.1017/S135561770066602X.

82. Popolo R, Dimaggio G, Luther L, Vinci G, Salvatore G, Lysaker PH. Theory of Mind in Schizophrenia. *J Nerv Ment Dis*. 2016;204(3):240-243. doi:10.1097/NMD.0000000000000454.

83. Rassovsky Y, Horan WP, Lee J, Sergi MJ, Green MF. Pathways between early visual processing and functional outcome in schizophrenia. *Psychol Med*. 2011;41(3):487-497. doi:10.1017/S0033291710001054.

84. Renard SB, Pijnenborg M, Lysaker PH. Dissociation and social cognition in schizophrenia spectrum disorder. *Schizophr Res*. 2012;137(1-3):219-223. doi:10.1016/j.schres.2012.02.001.

85. Rocca P, Galderisi S, Rossi A, et al. Social cognition in people with schizophrenia: a cluster-analytic approach. *Psychol Med*. 2016;46(13):2717-2729. doi:10.1017/S0033291716001100.

86. Romero-Ferreiro MV, Aguado L, Rodriguez-Torresano J, Palomo T, Rodriguez-Jimenez R, Pedreira-Massa JL. Facial affect recognition in early and late-stage schizophrenia patients. *Schizophr Res*. 2016;172(1-3):177-183. doi:10.1016/j.schres.2016.02.010.

87. Roncone R, Falloon IRH, Mazza M, et al. Is Theory of Mind in Schizophrenia More Strongly Associated with Clinical and Social Functioning than with Neurocognitive Deficits? *Psychopathology*. 2002;35(5):280-288. doi:10.1159/000067062.

88. Russell TA, Reynaud E, Herba C, Morris R, Corcoran R. Do you see what I see? Interpretations of intentional movement in schizophrenia. *Schizophr Res*. 2006;81(1):101-111. doi:10.1016/j.schres.2005.10.002.

89. Sachs G, Steger-Wuchse D, Kryspin-Exner I, Gur RC, Katschnig H. Facial recognition deficits and cognition in schizophrenia. *Schizophr Res*. 2004;68(1):27-35. doi:10.1016/S0920-9964(03)00131-2.

90. Sarfati Y, Hardy-Baylé MC. How do people with schizophrenia explain the behaviour of others? A study of theory of mind and its relationship to thought and speech disorganization in schizophrenia. *Psychol Med*. 1999;29:613-620. doi:10.1017/S0033291799008326.

91. Sarfati Y, Hardy-Baylé MC, Brunet E, Widlöcher D. Investigating theory of mind in schizophrenia: Influence of verbalization in disorganized and non-disorganized patients. *Schizophr Res*. 1999;37:183-190. doi:10.1016/S0920-9964(98)00154-6.

92. Sarfati Y, Hardy-Bayle M-C, Nadel J, Chevalier J-F, Widlocher D. Attribution of Mental States to Others by Schizophrenic Patients. *Cogn Neuropsychiatry*. 1997;2:1-18. doi:10.1080/135468097396388.

93. Sarfati Y, Hardy-Baylé MC, Besche C, Widlöcher D. Attribution of intentions to others in people with schizophrenia: A non- verbal exploration with comic strips. *Schizophr Res*. 1997;25:199-209. doi:10.1016/S0920-9964(97)00025-X.

94. Schneider F, Gur RC, Gur RE, Shtasel D l. Emotional processing in schizophrenia: Neurobehavioral pobes in relation to psychopathology. *Schizophr Res*. 1995;17:67-75.

95. Schenkel LS, Spaulding WD, Silverstein SM. Poor premorbid social functioning and theory of mind deficit in schizophrenia: Evidence of reduced context processing? *J Psychiatr Res*. 2005;39(5):499-508. doi:10.1016/j.jpsychires.2005.01.001.

96. Sergi MJ, Rassovsky Y, Widmark C, et al. Social cognition in schizophrenia: Relationships

with neurocognition and negative symptoms. *Schizophr Res*. 2007;90(1-3):316-324. doi:10.1016/j.schres.2006.09.028.

97. Shamay-Tsoory SG, Shur S, Barcai-Goodman L, Medlovich S, Harari H, Levkovitz Y. Dissociation of cognitive from affective components of theory of mind in schizophrenia. *Psychiatry Res*. 2007;149(1-3):11-23. doi:10.1016/j.psychres.2005.10.018.

98. Shean G, Meyer J. Symptoms of schizophrenia and social cognition. *Psychiatry Res*. 2009;170(2-3):157-160. doi:10.1016/j.psychres.2009.01.023.

99. Shean G, Murphy A, Meyer J. Social cognition and symptom dimensions. *J Nerv Ment Dis*. 2005;193(11):751-755. doi:10.1097/01.nmd.0000185868.58587.5b.

100. Shur S, Shamay-Tsoory SG, Levkovitz Y. Integration of emotional and cognitive aspects of theory of mind in schizophrenia and its relation to prefrontal neurocognitive performance. *Cogn Neuropsychiatry*. 2008;13(6):472-490. doi:10.1080/13546800802490034.

101. Silver H. Perception of facial emotions in chronic schizophrenia does not correlate with negative symptoms but correlates with cognitive and motor dysfunction . *Schizophr Res*. 2001;52(3):265 <last_page> 273. doi:10.1016/S0920-9964(00)00093-1.

102. Smith MJ, Horan WP, Cobia DJ, et al. Performance-based empathy mediates the influence of working memory on social competence in Schizophrenia. *Schizophr Bull*. 2014;40(4):824-834. doi:10.1093/schbul/sbt084.

103. Smith MJ, Horan WP, Karpouzian TM, Abram S V., Cobia DJ, Csernansky JG. Self-reported empathy deficits are uniquely associated with poor functioning in schizophrenia. *Schizophr Res*. 2012;137(1-3):196-202. doi:10.1016/j.schres.2012.01.012.

104. Sparks A, McDonald S, Lino B, O'Donnell M, Green MJ. Social cognition, empathy and functional outcome in schizophrenia. *Schizophr Res*. 2010;122(1-3):172-178. doi:10.1016/j.schres.2010.06.011.

105. Stratta P, Riccardi I, Mirabilio D, Di Tommaso S, Tomassini A, Rossi A. Exploration of irony appreciation in schizophrenia: A replication study on an Italian sample. *Eur Arch Psychiatry Clin Neurosci*. 2007;257(6):337-339. doi:10.1007/s00406-007-0729-z.

106. Subotnik KL, Nuechterlein KH, Green MF, et al. Neurocognitive and social cognitive correlates of formal thought disorder in schizophrenia patients. *Schizophr Res*. 2006;85:84-95. doi:10.1016/j.schres.2006.03.007.

107. Tan EJ, Rossell SL. Building a neurocognitive profile of thought disorder in schizophrenia using a standardized test battery. *Schizophr Res*. 2014;152(1):242-245. doi:10.1016/j.schres.2013.11.001.

108. Tang XW, Yu M, Duan WW, et al. Facial emotion recognition and alexithymia in Chinese male patients with deficit schizophrenia. *Psychiatry Res*. 2016;246(September 2015):353-359. doi:10.1016/j.psychres.2016.09.055.

109. Toomey R, Schuldberg D, Corrigan P, Green MF. Nonverbal social perception and symptomatology in schizophrenia. *Schizophr Res*. 2002;53(1-2):83-91. doi:10.1016/S0920-9964(01)00177-3.

110. Tschacher W, Kupper Z. Perception of causality in schizophrenia spectrum disorder. *Schizophr Bull*. 2006;32(SUPPL.1). doi:10.1093/schbul/sbl018.

111. Tseng HH, Chen SH, Liu CM, et al. Facial and Prosodic Emotion Recognition Deficits Associate with Specific Clusters of Psychotic Symptoms in Schizophrenia. *PLoS One*. 2013;8(6). doi:10.1371/journal.pone.0066571.

112. Tso IF, Mui ML, Taylor SF, Deldin PJ. Eye-contact perception in schizophrenia: Relationship with symptoms and socioemotional functioning. *J Abnorm Psychol*. 2012;121(3):616-627. doi:10.1037/a0026596.

113. Tsotsi S, Bozikas VP, Kosmidis MH. The role of attention processes in facial affect recognition in schizophrenia. *Cogn Neuropsychiatry*. 2015;6805(March):in press. doi:10.1080/13546805.2015.1110517.

114. Turetsky BI, Kohler CG, Indersmitten T, Bhati MT, Charbonnier D, Gur RC. Facial emotion recognition in schizophrenia:When and why does it go awry? *Schizophr Res*. 2007;94(1-3):253-263. doi:10.1016/j.schres.2007.05.001.

115. Uhlhaas PJ, Phillips W a, Schenkel LS, Silverstein SM. Theory of mind and perceptual context-processing in schizophrenia. *Cogn Neuropsychiatry*. 2006;11(4):416-436. doi:10.1080/13546800444000272.

116. Urbach M, Brunet-Gouet E, Bazin N, Hardy-Baylé MC, Passerieux C. Correlations of theory of mind deficits with clinical patterns and quality of life in schizophrenia. *Front Psychiatry*. 2013;4(MAY). doi:10.3389/fpsyt.2013.00030.

117. Vaskinn A, Sergi MJ, Green MF. The challenges of ecological validity in the measurement of

social perception in schizophrenia. *J Nerv Ment Dis*. 2009;197(9):700-702. doi:10.1097/NMD.0b013e3181b3ae62.

118. Ventura J, Ered A, Gretchen-Doorly D, et al. Theory of mind in the early course of schizophrenia: stability, symptom and neurocognitive correlates, and relationship with functioning. *Psychol Med*. 2015;45:2031-2043. doi:10.1017/S0033291714003171.

119. Vohs JL, Lysaker PH, Francis MM, et al. Metacognition, social cognition, and symptoms in patients with first episode and prolonged psychoses. *Schizophr Res*. 2014;153(1-3):54-59. doi:10.1016/j.schres.2014.01.012.

120. Weniger G, Lange C, Rüther E, Irle E. Differential impairments of facial affect recognition in schizophrenia subtypes and major depression. *Psychiatry Res*. 2004;128(2):135-146. doi:10.1016/j.psychres.2003.12.027.

121. Wolfkuhler W, Majorek K, Tas C, et al. Emotion recognition in pictures of facial affect: Is there a difference between forensic and non-forensic patients with schizophrenia? *Eur J Psychiatry*. 2012;26(2):73-85. doi:10.4321/s0213-61632012000200001.

122. Woodward TS, Mizrahi R, Menon M, Christensen BK. Correspondences between theory of mind, jumping to conclusions, neuropsychological measures and the symptoms of schizophrenia. *Psychiatry Res*. 2009;170(2-3):119-123. doi:10.1016/j.psychres.2008.10.018.

123. Zalla T, Bouchilloux N, Labruyere N, Georgieff N, Bougerol T, Franck N. Impairment in event sequencing in disorganised and non-disorganised patients with schizophrenia. *Brain Res Bull*. 2006;68(4):195-202. doi:10.1016/j.brainresbull.2005.04.020.

Appendix F. Supplementary analyses

ToM

Individual analyses by symptom group revealed an ES of -0.353 (k= 36; 95% CI [-0.409; -0.293]; z= -10.885; p< 0.001) for the association between ToM and disorganisation; -0.337 (k= 18; 95% CI [-0.423; -0.245]; z= -6.823; p< 0.001) for the association with TD; and finally, -0.342 (k= 10; 95% CI [-0.478; -0.190]; z= -4.260; p< 0.001) for the association with alogia. All analyses carried a significant level of heterogeneity (Disorganisation: Q[35]= 125.242; p< 0.001; I^2= 72.054; τ^2= 0.025; SE= 0.012; var= 0.000; τ= 0.158; TD: Q[17]= 36.727; p= 0.004; I^2= 53.712; τ^2= 0.024; SE= 0.016; var= 0.000; τ= 0.154; alogia: Q[9]= 20.507; p= 0.015; I^2= 56.113; τ^2= 0.037; SE= 0.033; var= 0.001; τ= 0.192) and there were no significant differences across the three ES (Q[2] = 0.088; p= 0.957).

Social perception

The analyses by symptom group revealed an ES of -0.258 (k= 8; 95% CI [-0.387; -0.119]; z= -3.586; p< 0.001) for the association between social perception and disorganisation; -0.241 (k= 5; 95% CI [-0.362; -0.112]; z= -3.618; p< 0.001) for the association with TD; and finally, -0.105 (k= 4; 95% CI [-0.198; -0.010]; z= -2.156; p= 0.031) for the association with alogia. All analyses revealed a non-significant level of heterogeneity (Disorganisation: Q[7]= 9.444; p= 0.222; I^2= 25.887; τ^2= 0.011; SE= 0.023; var= 0.001; τ= 0.105; TD: Q[4]= 2.337; p= 0.674; I^2= 0.000; τ^2= 0.000; SE= 0.019; var= 0.000; τ= 0.000; alogia: Q[3]= 1.867; p= 0.601; I^2= 0.000; τ^2= 0.000; SE= 0.008; var= 0.000; τ= 0.000) and there were no significant differences across the three ES (Q[2] = 4.573; p= 0.102).

Emotion recognition

The analyses by symptom group revealed an ES of -0.333 (k= 35; 95% CI [-0.384; -0.280]; z= -11.628; p< 0.001) for the association between emotion recognition and disorganisation; -0.302 (k= 10; 95% CI [-0.402; -0.195]; z= -5.339; p= 0.001) for the association with TD; and finally, -0.397 (k= 11; 95% CI [-0.551; -0.217]; z= -4.125; p< 0.001) for the association with alogia. Analyses revealed variable levels of heterogeneity (Disorganisation: Q[34]= 63.631; p= 0.002; I^2= 46.567; τ^2= 0.012; SE= 0.008; var= 0.000; τ= 0.110; TD: Q[9]= 14.084; p= 0.119; I^2= 36.100; τ^2= 0.012; SE= 0.015; var= 0.000; τ= 0.108; alogia: Q[10]= 37.942; p< 0.001; I^2= 73.644; τ^2= 0.079; SE= 0.053; var= 0.003; τ= 0.282) but there were no significant differences across the three ES (Q[2] = 0.875; p= 0.646).

Attributional biases/style

The analyses by symptom group revealed an ES of -0.307 (k= 2; 95% CI [-0.494; -0.092]; z= -2.761; p= 0.006) for the association between attributional style and disorganisation (Q[1]= 0.917; p= 0.338; I^2= 0.000; τ^2= 0.000; SE= 0.037; var= 0.001; τ= 0.000); 0.060 (k= 1; 95% CI [-0.361; 0.461]; z= 0.269; p= 0.788) for the association with TD; and finally, 0.010 (k= 1; 95% CI [-0.204; 0.223]; z= 0.091; p= 0.928) for the association with alogia. Analyses revealed no significant differences across the three ES (Q[2] = 4.973; p= 0.083).

Emotion processing and regulation

The analyses by symptom group revealed an ES of -0.172 (k= 5; 95% CI [-0.274; -0.066]; z= -3.167; p= 0.002) for the association between emotion processing and disorganisation; -0.231 (k= 6; 95% CI [-0.368; -0.085]; z= -3.062; p= 0.002) for the association with TD; and finally, -0.056 (k= 6; 95% CI [-0.184; 0.074]; z= -0.843; p= 0.399) for the association with alogia. All analyses carried non-significant levels of heterogeneity (Disorganisation: Q[4]= 2.902; p=

0.574; I^2= 0.000; τ^2= 0.000; SE= 0.011; var= 0.000; τ= 0.000; TD: Q[5]= 7.382; p= 0.194; I^2= 32.266; τ^2= 0.011; SE= 0.022; var= 0.000; τ= 0.106; alogia: Q[5]= 4.449; p= 0.487; I^2= 0.000; τ^2= 0.000; SE= 0.018; var= 0.000; τ= 0.000) and there were no significant differences across the three ES (Q[2] = 3.429; p= 0.180).

Appendix G. Effect-sizes by socio-cognitive domain

Domain	**k**	**Effect-size** (r)
Theory-of-Mind/mentalisation	59	**-0.349** 95%CI (-0.396; -0.301); *z*= -13.269 p< 0.001
Social perception	17	**-0.188** 95%CI (-0.256; -0.117); *z*= -5.158 p< 0.001
Emotion recognition	53	**-0.334** 95%CI (-0.380; -0.286); *z*= -12.842 p< 0.001
Attributional style/biases	4	**-0.143** 95%CI (-0.347; 0.073); *z*= -1.298 p= 0.194
Emotion processing/regulation	14	**-0.169** 95%CI (-0.243; -0.092); *z*= -4.287 p< 0.001

Table – Effect-sizes by socio-cognitive domain.

Appendix H. Funnel plot

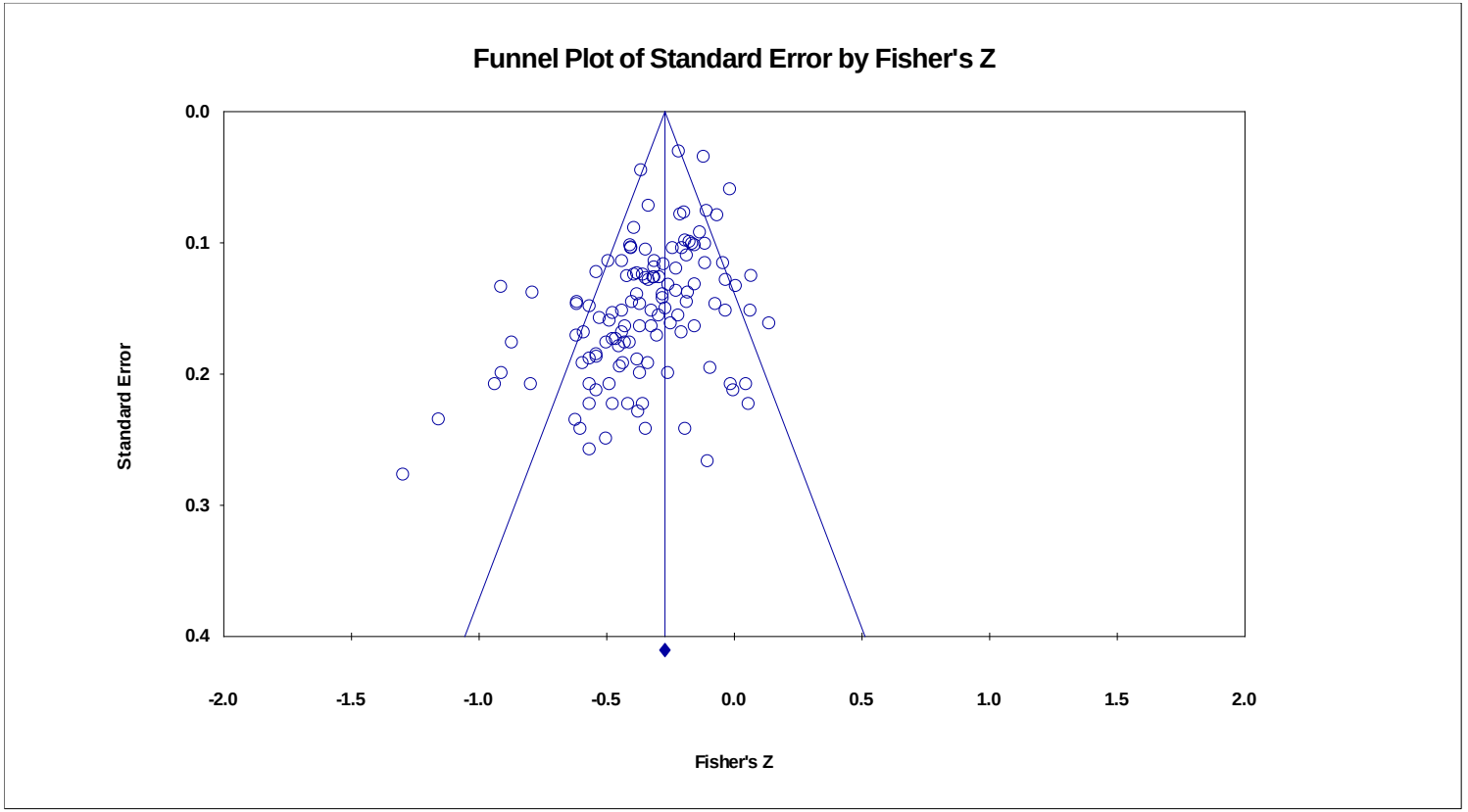


Figure - Funnel plot.

Appendix I. Psych Res author guidelines

Guidelines for full-length article

Abstract: single paragraph, covering aims of the study, methods used, the results, and major conclusions, with no structure or statistical data (150-200 words).

Key words: 7.

Highlights: 3-5 bullet points to convey core findings (mandatory).

Text: Introduction (preceded by arabic number 1.), Methods (preceded by number 2.), Results (preceded by number 3.), Discussion (preceded by number 4.), Acknowledgment (optional section following the discussion, which should not be preceded by a numeral), and References (should not be preceded by a numeral). Lower level heading should be numbered.

Word limit: 5000 (without tables, figures, or references).

Acknowledgements: Placed before references.

Conflict of interest: Up to three years from beginning of work submitted.

Contributors: Role of all the co-authors in the study.

Role of the funding source: Identification of sources of funding support.

Ethical statement: Statement in the manuscript to report that informed consent was obtained to carry out the research with human beings.

Reference style: Psychiatry Research citation style (Mendeley).

Tables and Figures: Number not specified.

Appendix J. Participant information sheet

28/09/2016 version 1.2
IRAS Project ID: 211422

Participant Information Sheet

Title of Study: *Testing the role of social isolation and social cognition in thought disorder*
Researchers: Professor Richard Bentall, Professor William Sellwood and Dr. Paulo Sousa

Dear prospective participant,

I'm inviting you to take part in a research study. Before you decide whether you want to take part or not, it is extremely important that you understand why this research is being done and what it will actually involve. Please take time to read the following information sheet carefully and feel free to ask me if there is anything that you do not understand. Please also feel free to discuss your participation with your friends and relatives if you wish. I would like to stress that you do not have to accept this invitation and should only agree to take part if you really want to.

1. What is the purpose of the study?
The purpose of the current study is to look at the impact of social isolation on your thoughts and mental health.

2. Why have I been chosen to take part?
You have been chosen because we are interested in looking at the impact of social isolation on the thinking and thoughts of people who are experiencing, or may have experienced, mental health difficulties.

3. Do I have to take part?
Absolutely not, your participation is entirely voluntary. It is up to you to decide if you want to take part and you may discuss your potential participation with your family and friends.

4. What will happen if I take part?
If you agree to take part, I will arrange for us to meet at a mutually convenient time and location. The meeting should not take more than 80 minutes. During that time, I will ask you to tell me about your mental health difficulties and to complete a questionnaire about social isolation (18 questions) and two 10-minute tasks in which you have to guess emotions and thoughts from people's faces and short-stories. During the session, you can have 10-minute break if necessary. With your permission, I will audio record the interviews so that I can listen to them with more time at a later stage. The recording can be stopped at any time and have words deleted or replaced.

5. Will I be paid if I decide to take part?
Yes, you'll be paid £10 for your participation and we will reimburse you for any reasonable travelling expenses.

6. Are there any risks in taking part?
You may experience distress when we discuss your mental health difficulties.

7. Are there any benefits in taking part?
There is no direct benefit for you but we hope that your involvement will help future service users.

8. What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting Professor Richard Bentall on 0151 795 5367 (*rpb@liverpool.ac.uk*) and we will try to help. If you remain unhappy or have a complaint which you feel you cannot come to us with, then you should contact the Research Governance Officer on 0151 794 8290 (*ethics@liv.ac.uk*). When contacting the Research Governance Officer, please provide details of the name or description of the study (so that it can be identified), the researcher involved, and the details of the complaint you wish to make.

9. Will my participation be kept confidential?

Your participation, and all the information gathered during the meetings, will remain confidential. However, if you disclose information, which indicates that you wish to harm yourself or others, confidentiality will have to be broken and I will have to inform the relevant authority. The questionnaires and tapes (audio-recording) will be kept in a locked cabinet in the University of Liverpool and all personal information will be deleted.

10. Will my taking part be covered by an insurance scheme?

Yes, as the study is sponsored by the University of Liverpool and they provide an insurance scheme for researchers.

11. What will happen to the results of the study?

The results of the study will be submitted for publication with scientific journals. You can opt to be sent a copy of the results. In order to do this, we will need to keep a record of your name and address. This information will be kept in a secured and password protected computer file and destroyed after letters are sent out. Study results are likely to be published online within a year of the end of the study (07/2018). No publication deriving from this study will include your personal details or information that can identify you in any way. The research data produce will be made openly available to the wider academic community in accordance with the University of Liverpool Research Data Management Policy and published results may include information on how to access the supporting data.

12. What will happen if I want to stop taking part?

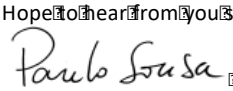
You are free to withdraw from the study at anytime. If you chose to do so, I will ask you if you are happy for me to use the information gathered up to the period of your withdrawal. If not, I will destroy the data and no further use will be made of it. If you decide to withdraw you will still be paid £10.

13. Who can I contact if I have further questions?

If you have any further questions or things that you would like to see clarified before you decide if you want to take part or not, please feel free to contact me:

Paulo Sousa
Department of Clinical Psychology
University of Liverpool
Whelan Building
The Quadrangle
Brownlow Hill
Liverpool
L69 3GB
sousa@liv.ac.uk

Hope to hear from you soon,



Appendix L. Participant consent form

01/08/2016 version 1.1
IRAS Project ID: 211422

UNIVERSITY OF LIVERPOOL

INFORMED CONSENT FORM

Title of Research Project:	*Testing the role of social isolation and social cognition in thought disorder*	
Researcher(s):	Professor Richard Bentall, Professor William Sellwood and Dr Paulo Sousa	*Please tick box*

1. I confirm that I have read and have understood the information sheet dated ..... for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily by the researcher. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without my rights being affected. ☐
3. I understand that, under the Data Protection Act, I can at any time ask for access to the information I have provided and that I can also request the destruction of that information if I wish. ☐
4. I understand that the study involves the audio recording of interviews and I have been informed that only the research team will be able to listen to these and that I can request the destruction of these recordings if I wish. ☐
5. I understand that relevant sections of my medical notes and data collected during the study, may be looked at by individuals the sponsor, from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. ☐
6. I agree to take part in the above study. ☐

_____	_____	_____
Participant Name	*Date*	*Signature*
_____	_____	_____
Name of person taking consent	*Date*	*Signature*
_____	_____	_____
Researcher	*Date*	*Signature*

One copy should be given to the participant, one copy retained by the research team and, for patient participants, one copy placed in the medical records.

The contact details of the Lead Researcher (Principal Investigator) are:

Professor Richard Bentall
Department of Psychological Sciences,
University of Liverpool,
Room 108,
Eleanor Rathbone Building
Liverpool L69 7ZA
(0)151 795 5367
Richard.Bentall@liverpool.ac.uk

Appendix M. Structured Clinical Interview (SCI-PANSS)

The Structured Clinical Interview for the Positive and Negative Syndrome Scale (SCI-PANSS)

Patient Name:
Interviewer:
Date:

Data on Lack of Spontaneity and Flow of Conversation," (N6) "Poor Rapport," (N3) and "Conceptual Disorganization" (P2)

"Hi, I'm… We're going to be spending the next 30 to 40 minuets talking about you and your reasons for being here. Maybe you can start out by telling me something about yourself and your background?"

(Instructions to interviewer: Allow at least 5 minuets for a non-directive phase serving to establish rapport in the context of an overview before preceding to the specific questions listed below.)

Data on "Anxiety" (G2)

Have you been feeling worried or nervous in the past week?
IF NO: Would you say that you're usually calm and relaxed?
IF YES: What's been making you feel nervous (worried, uncalm, unrelaxed)?
Just how nervous have you been feeling?
Have you been shaking at times, or has your heart been racing?
Do you get into a state of panic?
Has your sleep, eating, or participation in activities been affected?

Data on "Delusions" (P1) and "Unusual Thought Content" (G9)

Have things been going well for you?
Has anything been bothering you lately?
Can you tell me something about your thoughts on life and its purpose?
Do you follow a particular philosophy?
Some people tell me they believe in the Devil; what do you think?
Can you read other people's minds?
IF YES: How does this work?
Can other people read your mind?
IF YES: How can they do that?

Is there any reason that someone would want to read your mind?
Who controls your thoughts?

Data on "Suspiciousness/Persecution," (P6) "Passive/Apathetic Social Withdrawal," (N4) "Active Social Avoidance," (G16) and "Poor Impulse Control" (G14)

How do you spend your time these days?
Do you prefer to be alone?
Do you join in activities with others?
IF NO: Why not?...Are you afraid of people, or do you dislike them?
IF YES: Can you explain?
IF YES: Tell me about it.
Do you have many friends?
IF NO: Just a few?
IF NO: Any?...Why?
IF YES: Why just a few friends?
IF YES: Close friends?
IF NO: Why not?
Do you feel that you ca trust most people?
IF NO: Why not?
Are there some people in particular that you don't trust?
IF YES: Can you tell me who they are?
Why don't you trust people (or name specific person)?
IF "DON'T KNOW" OR "DON'T WANT TO SAY": Do you have good reason not to trust…?
Is there something that…did to you?
Perhaps might do to you now?
IF YES: Can you explain to me?
Do you get along with others?
IF NO: What's the problem?
Do you have a quick temper?
Do you get into fights?
IF YES: How do these fights start?
Tell me about these fights.
How often does this happen?
Do you sometimes lose control of yourself?
Do you like most people?
IF NO: Why not?
Are there perhaps some people who don't like you?
IF YES: For what reason?
Do others talk about you behind your back?
IF YES: What do they say about you?
Why?
Does anyone ever spy on you or plot against you?
Do you sometimes feel in danger?

IF YES: would you say that your life is in danger?
Is someone thinking of harming you or even perhaps thinking of killing you?
Have you gone to the police for help?
Do you sometimes take matters into your own hands or take action on those who might harm you?
IF YES: What have you done?

Data on "Hallucinatory Behavior" (P3) and associated delusions

Do you once in a while have a strange or unusual experience?
Sometimes people tell me that they can hear noises or voices inside their head that others can't hear. What about you?
IF NO: Do you sometimes receive personal communications from the radio or TV?
IF NO: From God or the Devil?
IF YES: What do you hear?
Are these as clear and loud as my voice?
How often do you hear these voices (noises, messages, etc.)?
Does this happen at a particular time of day or all the time?
IF HEARING VOICES: Can you recognize whose voices these are?
What do the voices say?
Are the voices good or bad?
Pleasant or unpleasant?
Do the voices interrupt your thinking or your activities?
Do they sometimes give you orders or instructions?
IF YES: For example?
Do you usually obey these orders (instructions)?
What do you make of these voices (or noises): where do they come from?
Why do you have these experiences?
Do ordinary things sometimes look strange and distorted to you?
Do you sometimes have "visions" or see things others can't see?
IF YES: For example?
Do these visions seem very real or life like?
How often do you have these experiences?
Do you sometimes smell things that are unusual or that others don't smell?
IF YES: Please explain.
Do you get any strange or unusual sensations from inside your body?
IF YES: Tell me about this.

Data on "Somatic Concern" (G1)

How have you been feeling in terms of your health?
IF OTHER THAN" GOOD": What has been troubling you?
IF "GOOD": Do you consider yourself in top health?
IF NO: What has been troubling you?

Do you have any medical illness or disease?
Has any part of your body been troubling you?
IF NO: how is your head? Your heart? Stomach? The rest of your body?
IF YES: Could you explain?
Have your head or body changed in shape or size?
IF YES: Please explain.
What is causing these changes?

Data on "Depression" (G6)
How has your mood been in the past week: mostly good, mostly bad?
IF MOSTLY GOOD: Have there been times in the last week that you were feeling sad or unhappy? IF YES, NEXT QUESTION:
IF 'MOSTLY BAD": Is there something in particular that is making you sad?
How often do you feel sad?
Just how sad have you been feeling?
Have you been crying lately?
Has your mood in any way affected your sleep?
Has it affected your appetite?
Do you participate less in activities on account of your mood?
Have you had any thoughts of harming yourself?
IF YES: Any thoughts about ending your life?
IF YES: Have you attempted suicide?

Data on "Guilt Feelings" (G3) and "Grandiosity" (P5)

If you were to compare yourself to the average person, how would you come out: a little better, maybe a little worse, or about the same?
IF WORSE: Worse in what ways?
Just how do you feel about yourself?
IF BETTER: Better in what ways?
IF ABOUT THE SAME: Are you special in some ways?
IF YES: In what ways?
Would you consider yourself gifted?
Do you have any talents or abilities that most people don't have?
IF YES: Please explain.
Do you have any special powers?
IF YES: What are these?
Where do these powers come from?
Do you have extrasensory perception (ESP), or can you read other people's minds?
Are you very wealthy?
IF YES: Explain please.
Can you be considered to be very bright?
IF YES: Why would you say so?

Would you describe yourself as famous?
Would some people recognize you from TV, radio, or the newspaper?
IF YES: Can you tell me about it?
Are you a religious person?
IF YES: are you close to God?
IF YES: Did God assign you some special role or purpose?
Can you be considered one of God's messengers or angels?
IF YES: What special powers do you have as God's messenger (angel)?
Do you perhaps consider yourself to be God?
Do you have a special mission in life?
IF YES: What is that mission?
Who assigned you that mission?
Did you ever do something wrong – something you felt bad or guilty about?
IF YES: Just how much does that bother you now?
Do you feel that you deserve punishment for that?
IF YES: What kind of punishment do you deserve?
Have you at times thought of punishing yourself?
IF YES: Have you ever acted on these thoughts of punishing yourself?

Data on "Disorientation" (G10)

Can you tell me what is today's date (i.e. the day month, and year)?
What is the name of the place you are in now?
(If hospitalized :) What ward are you on?
What is the address of where you stay now?
If someone had to reach you by phone, what number would that person call?
What is the name of the doctor that is treating you?
(If hospitalized :) Can you tell me who else is on staff and what they do?
Do you know who is now the President?
Who is our Governor?
Who is the Mayor of this city?

Data on "Difficulty in Abstract Thinking" (N5)

I'm going to now say a pair of words, and I'd like you to tell me in what important way they are alike. Let's start, for example, with the words "apple" and "banana". How are they alike…what do they have in common?
IF "THEY ARE BOTH FRUIT": Good. Now what about…?
(*Select three other items from the Similarities list at varying levels of difficulty from Appendix A.*)

IF AN ANSWER IS GIVEN THAT IS CONCRETE, TANGENTIAL, OR IDIOSYNCRATIC, E.G., "THEY BOTH HAVE SKINS," "YOU CAN EAT

THEM," "THEY'RE SMALL," OR "MONKEYS LIKE THEM": Ok, but they're both fruit. Now how about…and…: how are these alike?
(Select three other items from the Similarities list at varying levels of difficulty from Appendix A.)

Appendix A

1. How are a ball and an orange alike?
2. Apple and banana?
3. Pencil and pen?
4. Nickel and dime?
5. Table and chair?
6. Tiger and elephant?
7. Hat and shirt?
8. Bus and train?
9. Arm and leg?
10. Rose and tulip?
11. Uncle and cousin?
12. The sun and the moon?
13. Painting and poem?
14. Hilltop and valley?
15. Air and water?
16. Peace and prosperity?

Note on Appendix A: Similarities are generally assessed by sampling four of the items at different levels of difficulty (i.e., one item selected from each quarter of the full set). When using the PANSS longitudinally, items should be systematically alternated with successive interviews so as to provide different selections from the various levels of difficulty and thus minimize repetition.

You have probably heard the expression, "Carrying a chip on the shoulder." What does that really mean?
There's a very old saying, "Don't judge a book by it's cover." What is the deeper meaning of this proverb?
(Select two other proverbs from the list in Appendix B at varying levels of difficulty.)

Appendix B
What does the saying mean:

1. "Plain as the nose on your face".
2. "Carrying a chip on your shoulder".
3. "Two heads are better than one".
4. "Two many cooks spoil the broth".
5. "Don't judge a book by its cover".

6. “One man’s food is another man’s poison”.
7. “All that glitters is not gold”.
8. “Don’t cross the bridge until you come to it”.
9. “What’s good for the gander is good for the gander”.
10. “The grass is always greener on the other side”.
11. “Don’t keep all your eggs in one basket”.
12. “One swallow does not make the summer”.
13. “A stitch in time saves nine”.
14. “A rolling stone gathers no moss”.
15. “The acorn never falls far from the tree”.
16. “People who live in glass houses should not throw stones at others”.

Note on Appendix B: Proverb interpretation is generally assessed by sampling four of the items at different levels of difficulty (i.e., one item selected from each quarter of the full set). When using the PANSS longitudinally, items should be systematically alternated with successive interviews so as to provide different selections from the various levels of difficulty and thus minimize repetition.

Data on “Lack of Judgment and Insights” (G12)

How long have you been in the hospital (clinical, etc.)?
Why did you come to the hospital (clinic, etc.)?
Did you need to be in the hospital (clinic, etc.)?
IF NO: Did you have a problem that needed treatment?
IF YES: Would you ay that you had a psychiatric or mental problem?
IF YES: Why?...would you say that you had a psychiatric or mental problem?
IF YES: Can you tell me what is consists of?
IF YES: In your own opinion, do you need to be taking medicine?
IF NO:
(If medicated :) Why then are you taking medication.
(If undedicated:) Why are you still in the hospital (clinic, etc.)
IF YES: Why?...Does the medicine help you in some way?
Do you at this time have any psychiatric or mental problems?
IF NO: For what reason are you still in the hospital (clinic, etc.)?
IF YES: Please explain.
Just how serious are these problems?
(If hospitalized:)
Are you ready yet for discharge from the hospital?
Do you think you’ll be taking medicine for your problems after discharge?
What are you’re future plans?
What about you’re longer range goals?

Appendix N. PANSS rating criteria and form

POSITIVE AND NEGATIVE SYNDROME SCALE (PANSS) RATING CRITERIA

GENERAL RATING INSTRUCTIONS

Data gathered from this assessment procedure are applied to the PANSS ratings. Each of the 30 items is accompanied by a specific definition as well as detailed anchoring criteria for all seven rating points. These seven points represent increasing levels of psychopathology, as follows:

1- absent

2- minimal

3- mild

4- moderate

5- moderate severe

6- severe

7- extreme

In assigning ratings, one first considers whether an item is at all present, as judging by its definition. If the item is absent, it is scored 1, whereas if it is present one must determine its severity by reference to the particular criteria from the anchoring points. The highest applicable rating point is always assigned, even if the patient meets criteria for lower points as well. In judging the level of severity, the rater must utilise a holistic perspective in deciding which anchoring point best characterises the patient's functioning and rate accordingly, whether or not all elements of the description are observed.

The rating points of 2 to 7 correspond to incremental levels of symptom severity:

- A rating of 2 (minimal) denotes questionable or subtle or suspected pathology, or it also may allude to the extreme end of the normal range.
- A rating of 3 (mild) is indicative of a symptom whose presence is clearly established but not pronounced and interferes little in day-to-day functioning.
- A rating of 4 (moderate) characterises a symptom which, though representing a serious problem, either occurs only occasionally or intrudes on daily life only to a moderate extent.
- A rating of 5 (moderate severe) indicates marked manifestations that distinctly impact on one's functioning but are not all-consuming and usually can be contained at will.
- A rating of 6 (severe) represents gross pathology that is present very frequently, proves highly disruptive to one's life, and often calls for direct supervision.
- A rating of 7 (extreme) refers to the most serious level of psychopathology, whereby the manifestations drastically interfere in most or all major life functions, typically necessitating close supervision and assistance in many areas.

Each item is rated in consultation with the definitions and criteria provided in this manual. The ratings are rendered on the PANSS rating form overleaf by encircling the appropriate number following each dimension.

PANSS RATING FORM

		absent	minimal	mild	moderate	moderate severe	severe	extreme
P1	Delusions	1	2	3	4	5	6	7
P2	Conceptual disorganisation	1	2	3	4	5	6	7
P3	Hallucinatory behaviour	1	2	3	4	5	6	7
P4	Excitement	1	2	3	4	5	6	7
P5	Grandiosity	1	2	3	4	5	6	7
P6	Suspiciousness/persecution	1	2	3	4	5	6	7
P7	Hostility	1	2	3	4	5	6	7
N1	Blunted affect	1	2	3	4	5	6	7
N2	Emotional withdrawal	1	2	3	4	5	6	7
N3	Poor rapport	1	2	3	4	5	6	7
N4	Passive/apathetic social withdrawal	1	2	3	4	5	6	7
N5	Difficulty in abstract thinking	1	2	3	4	5	6	7
N6	Lack of spontaneity & flow of conversation	1	2	3	4	5	6	7
N7	Stereotyped thinking	1	2	3	4	5	6	7
G1	Somatic concern	1	2	3	4	5	6	7
G2	Anxiety	1	2	3	4	5	6	7
G3	Guilt feelings	1	2	3	4	5	6	7
G4	Tension	1	2	3	4	5	6	7
G5	Mannerisms & posturing	1	2	3	4	5	6	7
G6	Depression	1	2	3	4	5	6	7
G7	Motor retardation	1	2	3	4	5	6	7
G8	Uncooperativeness	1	2	3	4	5	6	7
G9	Unusual thought content	1	2	3	4	5	6	7
G10	Disorientation	1	2	3	4	5	6	7
G11	Poor attention	1	2	3	4	5	6	7
G12	Lack of judgement & insight	1	2	3	4	5	6	7
G13	Disturbance of volition	1	2	3	4	5	6	7
G14	Poor impulse control	1	2	3	4	5	6	7
G15	Preoccupation	1	2	3	4	5	6	7
G16	Active social avoidance	1	2	3	4	5	6	7

SCORING INSTRUCTIONS

Of the 30 items included in the PANSS, 7 constitute a **Positive Scale**, 7 a **Negative Scale**, and the remaining 16 a **General Psychopathology Scale**. The scores for these scales are arrived at by summation of ratings across component items. Therefore, the potential ranges are 7 to 49 for the Positive and Negative Scales, and 16 to 112 for the General Psychopathology Scale. In addition to these measures, a Composite Scale is scored by subtracting the negative score from the positive score. This yields a bipolar index that ranges from –42 to +42, which is essentially a difference score reflecting the degree of predominance of one syndrome in relation to the other.

POSITIVE SCALE (P)

P1. **DELUSIONS** - Beliefs which are unfounded, unrealistic and idiosyncratic.

Basis for rating - Thought content expressed in the interview and its influence on social relations and behaviour.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Presence of one or two delusions which are vague, uncrystallised and not tenaciously held. Delusions do not interfere with thinking, social relations or behaviour.
4 **Moderate** - Presence of either a kaleidoscopic array of poorly formed, unstable delusions or a few well-formed delusions that occasionally interfere with thinking, social relations or behaviour.
5 **Moderate Severe** - Presence of numerous well-formed delusions that are tenaciously held and occasionally interfere with thinking, social relations and behaviour.
6 **Severe** - Presence of a stable set of delusions which are crystallised, possibly systematised, tenaciously held and clearly interfere with thinking, social relations and behaviour.
7 **Extreme** - Presence of a stable set of delusions which are either highly systematised or very numerous, and which dominate major facets of the patient's life. This frequently results in inappropriate and irresponsible action, which may even jeopardise the safety of the patient or others.

P2. **CONCEPTUAL DISORGANISATION -** Disorganised process of thinking characterised by disruption of goal-directed sequencing, e.g. circumstantiality, loose associations, tangentiality, gross illogicality or thought block.

Basis for rating - Cognitive-verbal processes observed during the course of interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Thinking is circumstantial, tangential or paralogical. There is some difficulty in directing thoughts towards a goal, and some loosening of associations may be evidenced under pressure.
4 **Moderate** - Able to focus thoughts when communications are brief and structured, but becomes loose or irrelevant when dealing with more complex communications or when under minimal pressure.
5 **Moderate Severe** - Generally has difficulty in organising thoughts, as evidenced by frequent irrelevancies, disconnectedness or loosening of associations even when not under pressure.
6 **Severe** - Thinking is seriously derailed and internally inconsistent, resulting in gross irrelevancies and disruption of thought processes, which occur almost constantly.
7 **Extreme** - Thoughts are disrupted to the point where the patient is incoherent. There is marked loosening of associations, which result in total failure of communication, e.g. "word salad" or mutism.

P3. **HALLUCINATORY BEHAVIOUR -** Verbal report or behaviour indicating perceptions which are not generated by external stimuli. These may occur in the auditory, visual, olfactory or somatic realms.

Basis for rating - Verbal report and physical manifestations during the course of interview as well as reports of behaviour by primary care workers or family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - One or two clearly formed but infrequent hallucinations, or else a number of vague abnormal perceptions which do not result in distortions of thinking or behaviour.
4 **Moderate** - Hallucinations occur frequently but not continuously, and the patient's thinking and behaviour are only affected to a minor extent.
5 **Moderate Severe** - Hallucinations occur frequently, may involve more than one sensory modality, and tend to distort thinking and/or disrupt behaviour. Patient may have a delusional interpretation of these experiences and respond to them emotionally and, on occasion, verbally as well.
6 **Severe** - Hallucinations are present almost continuously, causing major disruption of thinking and behaviour. Patient treats these as real perceptions, and functioning is impeded by frequent emotional and verbal responses to them.
7 **Extreme** - Patient is almost totally preoccupied with hallucinations, which virtually dominate thinking and behaviour. Hallucinations are provided a rigid delusional interpretation and provoke verbal and behavioural responses, including obedience to command hallucinations.

P4. **EXCITEMENT -** Hyperactivity as reflected in accelerated motor behaviour, heightened responsivity to stimuli, hypervigilance or excessive mood lability.

Basis for rating - Behavioural manifestations during the course of interview as well as reports of behaviour by primary care workers or family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Tends to be slightly agitated, hypervigilant or mildly overaroused throughout the interview, but without distinct episodes of excitement or marked mood lability. Speech may be slightly pressured.
4 **Moderate** - Agitation or overarousal is clearly evident throughout the interview, affecting speech and general mobility, or episodic outbursts occur sporadically.
5 **Moderate Severe** - Significant hyperactivity or frequent outbursts of motor activity are observed, making it difficult for the patient to sit still for longer than several minutes at any given time.
6 **Severe** - Marked excitement dominates the interview, delimits attention, and to some extent affects personal functions such as eating or sleeping.
7 **Extreme** - marked excitement seriously interferes in eating and sleeping and makes interpersonal interactions virtually impossible. Acceleration of speech and motor activity may result in incoherence and exhaustion.

P5. **GRANDIOSITY -** Exaggerated self-opinion and unrealistic convictions of superiority, including delusions of extraordinary abilities, wealth, knowledge, fame, power and moral righteousness.

Basis for rating - Thought content expressed in the interview and its influence on behaviour.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Some expansiveness or boastfulness is evident, but without clear-cut grandiose delusions.
4 **Moderate** - Feels distinctly and unrealistically superior to others. Some poorly formed delusions about special status or abilities may be present but are not acted upon.
5 **Moderate Severe** - Clear-cut delusions concerning remarkable abilities, status or power are expressed and influence attitude but not behaviour.
6 **Severe** - Clear-cut delusions of remarkable superiority involving more than one parameter (wealth, knowledge, fame, etc) are expressed, notably influence interactions and may be acted upon.
7 **Extreme** - Thinking, interactions and behaviour are dominated by multiple delusions of amazing ability, wealth, knowledge, fame, power and/or moral stature, which may take on a bizarre quality.

P6. **SUSPICIOUSNESS/PERSECUTION -** Unrealistic or exaggerated ideas of persecution, as reflected in guardedness, ad distrustful attitude, suspicious hypervigilance or frank delusions that others mean harm.

Basis for rating – Thought content expressed in the interview and its influence on behaviour.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Presents a guarded or even openly distrustful attitude, but thoughts, interactions and behaviour are minimally affected.
4 **Moderate** - Distrustfulness is clearly evident and intrudes on the interview and/or behaviour, but there is no evidence of persecutory delusions. Alternatively, there may be indication of loosely formed persecutory delusions, but these do not seem to affect the patient's attitude or interpersonal relations.
5 **Moderate Severe** - Patient shows marked distrustfulness, leading to major disruption of interpersonal relations, or else there are clear-cut persecutory delusions that have limited impact on interpersonal relations and behaviour.
6 **Severe** - Clear-cut pervasive delusions of persecution which may be systematised and significantly interfere in interpersonal relations.
7 **Extreme** - A network of systematised persecutory delusions dominates the patient's thinking, social relations and behaviour.

P7. **HOSTILITY -** Verbal and nonverbal expressions of anger and resentment, including sarcasm, passive-aggressive behaviour, verbal abuse and assualtiveness.

Basis for rating – Interpersonal behaviour observed during the interview and reports by primary care workers or family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Indirect or restrained communication of anger, such as sarcasm, disrespect, hostile expressions and occasional irritability.
4 **Moderate** - Presents an overtly hostile attitude, showing frequent irritability and direct expression of anger or resentment.
5 **Moderate Severe** - Patient is highly irritable and occasionally verbally abusive or threatening.
6 **Severe** - Uncooperativeness and verbal abuse or threats notably influence the interview and seriously impact upon social relations. Patient may be violent and destructive but is not physically assualtive towards others.
7 **Extreme** - Marked anger results in extreme uncooperativeness, precluding other interactions, or in episode(s) of physical assault towards others.

NEGATIVE SCALE (N)

N1. **BLUNTED AFFECT -** Diminished emotional responsiveness as characterised by a reduction in facial expression, modulation of feelings and communicative gestures.

Basis for rating - Observation of physical manifestations of affective tone and emotional responsiveness during the course of the interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Changes in facial expression and communicative gestures seem to be stilted, forced, artificial or lacking in modulation.
4 **Moderate** - Reduced range of facial expression and few expressive gestures result in a dull appearance
5 **Moderate Severe** - Affect is generally 'flat' with only occasional changes in facial expression and a paucity of communicative gestures.
6 **Severe** - Marked flatness and deficiency of emotions exhibited most of the time. There may be unmodulated extreme affective discharges, such as excitement, rage or inappropriate uncontrolled laughter.
7 **Extreme** – Changes in facial expression and evidence of communicative gestures are virtually absent. Patient seems constantly to show a barren or 'wooden' expression.

N2. **EMOTIONAL WITHDRAWAL -** Lack of interest in, involvement with, and affective commitment to life's events.

Basis for rating - Reports of functioning from primary care workers or family and observation of interpersonal behaviour during the course of the interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Usually lack initiative and occasionally may show deficient interest in surrounding events.
4 **Moderate** - Patient is generally distanced emotionally from the milieu and its challenges but, with encouragement, can be engaged.
5 **Moderate Severe** - Patient is clearly detached emotionally from persons and events in the milieu, resisting all efforts at engagement. Patient appears distant, docile and purposeless but can be involved in communication at least briefly and tends to personal needs, sometimes with assistance.
6 **Severe** - Marked deficiency of interest and emotional commitment results in limited conversation with others and frequent neglect of personal functions, for which the patient requires supervision.
7 **Extreme** – Patient is almost totally withdrawn, uncommunicative and neglectful of personal needs as a result of profound lack of interest and emotional commitment.

N3. **POOR RAPPORT -** Lack of interpersonal empathy, openness in conversation and sense of closeness, interest or involvement with the interviewer. This is evidenced by interpersonal distancing and reduced verbal and nonverbal communication.

Basis for rating - Interpersonal behaviour during the course of the interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Conversation is characterised by a stilted, strained or artificial tone. It may lack emotional depth or tend to remain on an impersonal, intellectual plane.
4 **Moderate** - Patient typically is aloof, with interpersonal distance quite evident. Patient may answer questions mechanically, act bored, or express disinterest.
5 **Moderate Severe** - Disinvolvement is obvious and clearly impedes the productivity of the interview. Patient may tend to avoid eye or face contact.
6 **Severe** - Patient is highly indifferent, with marked interpersonal distance. Answers are perfunctory, and there is little nonverbal evidence of involvement. Eye and face contact are frequently avoided.
7 **Extreme** - Patient is totally uninvolved with the interviewer. Patient appears to be completely indifferent and consistently avoids verbal and nonverbal interactions during the interview.

N4. **PASSIVE/APATHETIC SOCIAL WITHDRAWAL -** Diminished interest and initiative in social interactions due to passivity, apathy, anergy or avolition. This leads to reduced interpersonal involvements and neglect of activities of daily living.

Basis for rating – Reports on social behaviour from primary care workers or family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Shows occasional interest in social activities but poor initiative. Usually engages with others only when approached first by them.
4 **Moderate** – Passively goes along with most social activities but in a disinterested or mechanical way. Tends to recede into the background.
5 **Moderate Severe** - Passively participates in only a minority of activities and shows virtually no interest or initiative. Generally spends little time with others.
6 **Severe** - Tends to be apathetic and isolated, participating very rarely in social activities and occasionally neglecting personal needs. Has very few spontaneous social contacts.
7 **Extreme** – Profoundly apathetic, socially isolated and personally neglectful.

N5. **DIFFICULTY IN ABSTRACT THINKING -** Impairment in the use of the abstract-symbolic mode of thinking, as evidenced by difficulty in classification, forming generalisations and proceeding beyond concrete or egocentric thinking in problem-solving tasks.

Basis for rating - Responses to questions on similarities and proverb interpretation, and use of concrete vs. abstract mode during the course of the interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Tends to give literal or personalised interpretations to the more difficult proverbs and may have some problems with concepts that are fairly abstract or remotely related.
4 **Moderate** - Often utilises a concrete mode. Has difficulty with most proverbs and some categories. Tends to be distracted by functional aspects and salient features.
5 **Moderate Severe** - Deals primarily in a concrete mode, exhibiting difficulty with most proverbs and many categories.
6 **Severe** - Unable to grasp the abstract meaning of any proverbs or figurative expressions and can formulate classifications for only the most simple of similarities. Thinking is either vacuous or locked into functional aspects, salient features and idiosyncratic interpretations.
7 **Extreme** - Can use only concrete modes of thinking. Shows no comprehension of proverbs, common metaphors or similes, and simple categories. Even salient and functional attributes do not serve as a basis for classification. This rating may apply to those who cannot interact even minimally with the examiner due to marked cognitive impairment.

N6. **LACK OF SPONTANEITY AND FLOW OF CONVERSATION -** Reduction in the normal flow of communication associated with apathy, avolition, defensiveness or cognitive deficit. This is manifested by diminished fluidity and productivity of the verbal interactional process.

Basis for rating - Cognitive-verbal processes observed during the course of interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** – Conversation shows little initiative. Patient's answers tend to be brief and unembellished, requiring direct and leading questions by the interviewer.
4 **Moderate** – Conversation lacks free flow and appears uneven or halting. Leading questions are frequently needed to elicit adequate responses and proceed with conversation.
5 **Moderate Severe** - Patient shows a marked lack of spontaneity and openness, replying to the interviewer's questions with only one or two brief sentences.
6 **Severe** - Patient's responses are limited mainly to a few words or short phrases intended to avoid or curtail communication. (e.g. "I don't know", "I'm not at liberty to say"). Conversation is seriously impaired as a result and the interview is highly unproductive.
7 **Extreme** - Verbal output is restricted to, at most, an occasional utterance, making conversation not possible.

N7. **STEREOTYPED THINKING -** Decreased fluidity, spontaneity and flexibility of thinking, as evidenced in rigid, repetitious or barren thought content.

Basis for rating - Cognitive-verbal processes observed during the interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Some rigidity shown in attitude or beliefs. Patient may refuse to consider alternative positions or have difficulty in shifting from one idea to another.
4 **Moderate** - Conversation revolves around a recurrent theme, resulting in difficulty in shifting to a new topic.
5 **Moderate Severe** - Thinking is rigid and repetitious to the point that, despite the interviewer's efforts, conversation is limited to only two or three dominating topics.
6 **Severe** – Uncontrolled repetition of demands, statements, ideas or questions which severely impairs conversation.
7 **Extreme** - Thinking, behaviour and conversation are dominated by constant repetition of fixed ideas or limited phrases, leading to gross rigidity, inappropriateness and restrictiveness of patient's communication.

GENERAL PSYCHOPATHOLOGY SCALE (G)

G1. **SOMATIC CONCERN -** Physical complaints or beliefs about bodily illness or malfunctions. This may range from a vague sense of ill being to clear-cut delusions of catastrophic physical disease.

Basis for rating - Thought content expressed in the interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Distinctly concerned about health or bodily malfunction, but there is no delusional conviction and overconcern can be allayed by reassurance.
4 **Moderate** - Complains about poor health or bodily malfunction, but there is no delusional conviction, and overconcern can be allayed by reassurance.
5 **Moderate Severe** - Patient expresses numerous or frequent complaints about physical illness or bodily malfunction, or else patient reveals one or two clear-cut delusions involving these themes but is not preoccupied by them.
6 **Severe** - Patient is preoccupied by one or a few clear-cut delusions about physical disease or organic malfunction, but affect is not fully immersed in these themes, and thoughts can be diverted by the interviewer with some effort.
7 **Extreme** – Numerous and frequently reported somatic delusions, or only a few somatic delusions of a catastrophic nature, which totally dominate the patient's affect or thinking.

G2. **ANXIETY -** Subjective experience of nervousness, worry, apprehension or restlessness, ranging from excessive concern about the present or future to feelings of panic.

Basis for rating - Verbal report during the course of interview and corresponding physical manifestations.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Expresses some worry, overconcern or subjective restlessness, but no somatic and behavioural consequences are reported or evidenced.
4 **Moderate** - Patient reports distinct symptoms of nervousness, which are reflected in mild physical manifestations such as fine hand tremor and excessive perspiration.
5 **Moderate Severe** - Patient reports serious problems of anxiety which have significant physical and behavioural consequences, such as marked tension, poor concentration, palpitations or impaired sleep.
6 **Severe** - Subjective state of almost constant fear associated with phobias, marked restlessness or numerous somatic manifestations.
7 **Extreme** - Patient's life is seriously disrupted by anxiety, which is present almost constantly and at times reaches panic proportion or is manifested in actual panic attacks.

G3. **GUILT FEELINGS** - Sense of remorse or self-blame for real or imagined misdeeds in the past.

Basis for rating - Verbal report of guilt feelings during the course of interview and the influence on attitudes and thoughts.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** – Questioning elicits a vague sense of guilt or self-blame for a minor incident, but the patient clearly is not overly concerned.
4 **Moderate** - Patient expresses distinct concern over his responsibility for a real incident in his life but is not pre-occupied with it and attitude and behaviour are essentially unaffected.
5 **Moderate Severe** - Patient expresses a strong sense of guilt associated with self-deprecation or the belief that he deserves punishment. The guilt feelings may have a delusional basis, may be volunteered spontaneously, may be a source of preoccupation and/or depressed mood, and cannot be allayed readily by the interviewer.
6 **Severe** - Strong ideas of guilt take on a delusional quality and lead to an attitude of hopelessness or worthlessness. The patient believes he should receive harsh sanctions as such punishment.
7 **Extreme** - Patient's life is dominated by unshakable delusions of guilt, for which he feels deserving of drastic punishment, such as life imprisonment, torture, or death. There may be associated suicidal thoughts or attribution of others' problems to one's own past misdeeds.

G4. **TENSION -**Overt physical manifestations of fear, anxiety, and agitation, such as stiffness, tremor, profuse sweating and restlessness.

Basis for rating - Verbal report attesting to anxiety and thereupon the severity of physical manifestations of tension observed during the interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Posture and movements indicate slight apprehensiveness, such as minor rigidity, occasional restlessness, shifting of position, or fine rapid hand tremor.
4 **Moderate** - A clearly nervous appearance emerges from various manifestations, such as fidgety behaviour, obvious hand tremor, excessive perspiration, or nervous mannerisms.
5 **Moderate Severe** - Pronounced tension is evidenced by numerous manifestations, such as nervous shaking, profuse sweating and restlessness, but can conduct in the interview is not significantly affected.
6 **Severe** - Pronounced tension to the point that interpersonal interactions are disrupted. The patient, for example, may be constantly fidgeting, unable to sit still for long, or show hyperventilation.
7 **Extreme** - Marked tension is manifested by signs of panic or gross motor acceleration, such as rapid restless pacing and inability to remain seated for longer than a minute, which makes sustained conversation not possible.

G5. **MANNERISMS AND POSTURING** – Unnatural movements or posture as characterised be an awkward, stilted, disorganised, or bizarre appearance.

Basis for rating - Observation of physical manifestations during the course of interview as well as reports from primary care workers or family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Slight awkwardness in movements or minor rigidity of posture
4 **Moderate** – Movements are notably awkward or disjointed, or an unnatural posture is maintained for brief periods.
5 **Moderate Severe** - Occasional bizarre rituals or contorted posture are observed, or an abnormal position is sustained for extended periods.
6 **Severe** - Frequent repetition of bizarre rituals, mannerisms or stereotyped movements, or a contorted posture is sustained for extended periods.
7 **Extreme** - Functioning is seriously impaired by virtually constant involvement in ritualistic, manneristic, or stereotyped movements or by an unnatural fixed posture which is sustained most of the time.

G6. **DEPRESSION** - Feelings of sadness, discouragement, helplessness and pessimism.

Basis for rating - Verbal report of depressed mood during the course of interview and its observed influence on attitude and behaviour.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Expresses some sadness of discouragement only on questioning, but there is no evidence of depression in general attitude or demeanor.
4 **Moderate** - Distinct feelings of sadness or hopelessness, which may be spontaneously divulged, but depressed mood has no major impact on behaviour or social functioning and the patient usually can be cheered up.
5 **Moderate Severe** - Distinctly depressed mood is associated with obvious sadness, pessimism, loss of social interest, psychomotor retardation and some interference in appetite and sleep. The patient cannot be easily cheered up.
6 **Severe** - Markedly depressed mood is associated with sustained feelings of misery, occasional crying, hopelessness and worthlessness. In addition, there is major interference in appetite and or sleep as well as in normal motor and social functions, with possible signs of self-neglect.
7 **Extreme** - Depressive feelings seriously interfere in most major functions. The manifestations include frequent crying, pronounced somatic symptoms, impaired concentration, psychomotor retardation, social disinterest, self neglect, possible depressive or nihilistic delusions and/or possible suicidal thoughts or action.

G7. **MOTOR RETARDATION** – Reduction in motor activity as reflected in slowing or lessening or movements and speech, diminished responsiveness of stimuli, and reduced body tone.

Basis for rating - Manifestations during the course of interview as well as reports by primary care workers as well as family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Slight but noticeable diminution in rate of movements and speech. Patient may be somewhat underproductive in conversation and gestures.
4 **Moderate** - Patient is clearly slow in movements, and speech may be characterised by poor productivity including long response latency, extended pauses or slow pace.
5 **Moderate Severe** – A marked reduction in motor activity renders communication highly unproductive or delimits functioning in social and occupational situations. Patient can usually be found sitting or lying down.
6 **Severe** - Movements are extremely slow, resulting in a minimum of activity and speech. Essentially the day is spent sitting idly or lying down.
7 **Extreme** - Patient is almost completely immobile and virtually unresponsive to external stimuli.

G8. **UNCOOPERATIVENESS -** Active refusal to comply with the will of significant others, including the interviewer, hospital staff or family, which may be associated with distrust, defensiveness, stubbornness, negativism, rejection of authority, hostility or belligerence.

Basis for rating - Interpersonal behaviour observed during the course of the interview as well as reports by primary care workers or family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Complies with an attitude of resentment, impatience, or sarcasm. May inoffensively object to sensitive probing during the interview.
4 **Moderate** - Occasional outright refusal to comply with normal social demands, such as making own bed, attending scheduled programmes, etc. The patient may project a hostile, defensive or negative attitude but usually can be worked with.
5 **Moderate Severe** - Patient frequently is incompliant with the demands of his milieu and may be characterised by other as an "outcast" or having "a serious attitude problem". Uncooperativeness is reflected in obvious defensiveness or irritability with the interviewer and possible unwillingness to address many questions.
6 **Severe** - Patient is highly uncooperative, negativistic and possibly also belligerent. Refuses to comply with the most social demands and may be unwilling to initiate or conclude the full interview.
7 **Extreme** - Active resistance seriously impact on virtually all major areas of functioning. Patient may refuse to join in any social activities, tend to personal hygiene, converse with family or staff and participate even briefly in an interview.

G9. **UNUSUAL THOUGHT CONTENT** - Thinking characterised by strange, fantastic or bizarre ideas, ranging from those which are remote or atypical to those which are distorted, illogical and patently absurd.

Basis for rating - Thought content expressed during the course of interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Thought content is somewhat peculiar, or idiosyncratic, or familiar ideas are framed in an odd context.
4 **Moderate** - Ideas are frequently distorted and occasionally seem quite bizarre.
5 **Moderate Severe** - Patient expresses many strange and fantastic thoughts, (e.g. Being the adopted son of a king, being an escapee from death row), or some which are patently absurd (e.g. Having hundreds of children, receiving radio messages from outer space from a tooth filling).
6 **Severe** - Patient expresses many illogical or absurd ideas or some which have a distinctly bizarre quality (e.g. having three heads, being a visitor from another planet).
7 **Extreme** - Thinking is replete with absurd, bizarre and grotesque ideas.

G10. **DISORIENTATION** - Lack of awareness of one's relationship to the milieu, including persons, place and time, which may be due to confusion or withdrawal.

Basis for rating - Responses to interview questions on orientation.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - General orientation is adequate but there is some difficulty with specifics. For example, patient knows his location but not the street address, knows hospital staff names but not their functions, knows the month but confuses the day of the week with an adjacent day, or errs in the date by more than two days. There may be narrowing of interest evidenced by familiarity with the immediate but not extended milieu, such as ability to identify staff but not the mayor, governor, or president.
4 **Moderate** - Only partial success in recognising persons, places and time. For example, patient knows he is in a hospital but not its name, knows the name of the city but not the borough or district, knows the name of his primary therapist but not many other direct care workers, knows the year or season but not sure of the month.
5 **Moderate Severe** - Considerable failure in recognising persons, place and time. Patient has only a vague notion of where he is and seems unfamiliar with most people in his milieu. He may identify the year correctly or nearly but not know the current month, day of week or even the season.
6 **Severe** - Marked failure in recognising persons, place and time. For example, patient has no knowledge of his whereabouts, confuses the date by more than one year, can name only one or two individuals in his current life.
7 **Extreme** - Patient appears completely disorientated with regard to persons, place and time. There is gross confusion or total ignorance about one's location, the current year and even the most familiar people, such as parents, spouse, friends and primary therapist.

G11. **POOR ATTENTION** - Failure in focused alertness manifested by poor concentration, distractibility from internal and external stimuli, and difficulty in harnessing, sustaining or shifting focus to new stimuli.

Basis for rating – Manifestations during the course of interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Limited concentration evidenced by occasional vulnerability to distraction and faltering attention toward the end of the interview.
4 **Moderate** - Conversation is affected by the tendency to be easily distracted, difficulty in long sustaining concentration on a given topic, or problems in shifting attention to new topics.
5 **Moderate Severe** - Conversation is seriously hampered by poor concentration, distractibility, and difficulty in shifting focus appropriately..
6 **Severe** - Patient's attention can be harnessed for only brief moments or with great effort, due to marked distraction by internal or external stimuli.
7 **Extreme** - Attention is so disrupted that even brief conversation is not possible.

G12. **LACK OF JUDGEMENT AND INSIGHT** - Impaired awareness or understanding of one's own psychiatric condition and life situation. This is evidenced by failure to recognise past or present psychiatric illness or symptoms, denial of need for psychiatric hospitalisation or treatment, decisions characterised by poor anticipation or consequences, and unrealistic short-term and long-range planning.

Basis for rating – Thought content expressed during the interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Recognises having a psychiatric disorder but clearly underestimates its seriousness, the implications for treatment, or the importance of taking measures to avoid relapse. Future planning may be poorly conceived.
4 **Moderate** - Patient shows only a vague or shallow recognition of illness. There may be fluctuations in acknowledgement of being ill or little awareness of major symptoms which are present, such as delusions, disorganised thinking, suspiciousness and social withdrawal. The patient may rationalise the need for treatment in terms of its relieving lesser symptoms, such as anxiety, tension and sleep difficulty.
5 **Moderate Severe** - Acknowledges past but not present psychiatric disorder. If challenged, the patient may concede the presence of some unrelated or insignificant symptoms, which tend to be explained away by gross misinterpretation or delusional thinking. The need for psychiatric treatment similarly goes unrecognised.
6 **Severe** - Patient denies ever having had a psychiatric disorder. He disavows the presence of any psychiatric symptoms in the past or present and, though compliant, denies the need for treatment and hospitalisation.
7 **Extreme** - Emphatic denial of past and present psychiatric illness. Current hospitalisation and treatment are given a delusional interpretation (e.g. as punishment fro misdeeds, as persecution by tormentors, etc), and the patient thus refuse to cooperate with therapists, medication or other aspects of treatment.

G13. **DISTURBANCE OF VOLITION** – Disturbance in the wilful initiation, sustenance and control of one's thoughts, behaviour, movements and speech.

Basis for rating - Thought content and behaviour manifested in the course of interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - There is evidence of some indecisiveness in conversation and thinking, which may impede verbal and cognitive processes to a minor extent.
4 **Moderate** - Patient is often ambivalent and shows clear difficulty in reaching decisions. Conversation may be marred by alteration in thinking, and in consequence, verbal and cognitive functioning are clearly impaired.
5 **Moderate Severe** - Disturbance of volition interferes in thinking as well as behaviour. Patient shows pronounced indecision that impedes the initiation and continuation of social and motor activities, and which also may be evidence in halting speech.
6 **Severe** - Disturbance of volition interferes in the execution of simple automatic motor functions, such as dressing or grooming, and markedly affects speech.
7 **Extreme** – Almost complete failure of volition is manifested by gross inhibition of movement and speech resulting in immobility and/or mutism.

G14. **POOR IMPULSE CONTROL** - Disordered regulation and control of action on inner urges, resulting in sudden, unmodulated, arbitrary or misdirected discharge of tension and emotions without concern about consequences.

Basis for rating – Behaviour during the course of interview and reported by primary care workers or family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Patient tends to be easily angered and frustrated when facing stress or denied gratification but rarely acts on impulse.
4 **Moderate** - Patient gets angered and verbally abusive with minimal provocation. May be occasionally threatening, destructive, or have one or two episodes involving physical confrontation or a minor brawl.
5 **Moderate Severe** - Patient exhibits repeated impulsive episodes involving verbal abuse, destruction of property, or physical threats. There may be one or two episodes involving serious assault, for which the patient requires isolation, physical restraint, or p.r.n. sedation.
6 **Severe** - Patient frequently is impulsive aggressive, threatening, demanding, and destructive, without any apparent consideration of consequences. Shows assualtive behaviour and may also be sexually offensive and possibly respond behaviourally to hallucinatory commands.
7 **Extreme** - Patient exhibits homicidal, sexual assaults, repeated brutality, or self-destructive behaviour. Requires constant direct supervision or external constraints because of inability to control dangerous impulses.

G15. **PREOCCUPATION -** Absorption with internally generated thoughts and feelings and with autistic experiences to the detriment of reality orientation and adaptive behaviour.

Basis for rating - Interpersonal behaviour observed during the course of interview.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Excessive involvement with personal needs or problems, such that conversation veers back to egocentric themes and there is diminished concerned exhibited toward others.
4 **Moderate** - Patient occasionally appears self-absorbed, as if daydreaming or involved with internal experiences, which interferes with communication to a minor extent.
5 **Moderate Severe** - Patient often appears to be engaged in autistic experiences, as evidenced by behaviours that significantly intrude on social and communicational functions, such as the presence of a vacant stare, muttering or talking to oneself, or involvement with stereotyped motor patterns.
6 **Severe** - Marked preoccupation with autistic experiences, which seriously delimits concentration, ability to converse, and orientation to the milieu. The patient frequently may be observed smiling, laughing, muttering, talking, or shouting to himself.
7 **Extreme** - Gross absorption with autistic experiences, which profoundly affects all major realms of behaviour. The patient constantly may be responding verbally or behaviourally to hallucinations and show little awareness of other people or the external milieu.

G16. **ACTIVE SOCIAL AVOIDANCE** - Diminished social involvement associated with unwarranted fear, hostility, or distrust.

Basis for rating - Reports of social functioning primary care workers or family.

1 **Absent** - Definition does not apply
2 **Minimal** - Questionable pathology; may be at the upper extreme of normal limits
3 **Mild** - Patient seems ill at ease in the presence of others of others and prefers to spend time alone, although he participates in social functions when required.
4 **Moderate** - Patient begrudgingly attends all or most social activities but may needs to be persuaded or may terminate prematurely on account of anxiety, suspiciousness, or hostility.
5 **Moderate Severe** - Patient fearfully or angrily keeps away from many social interactions despite others' efforts to engage him. Tends to spend unstructured time alone.
6 **Severe** - Patient participates in very few social activities because of fear, hostility, or distrust. When approached, the patient shows a strong tendency to break off interactions, and generally he tends to isolate himself from others.
7 **Extreme** - Patient cannot be engaged in social activities because of pronounced fears, hostility, or persecutory delusions. To the extent possible, he avoids all interactions and remains isolated from others.

Appendix O. Thought, language, and communication (TLC) – definitions, scoring criteria, and sheet

TLC item	Definition	Scoring criteria	Weighting*
Poverty of speech	Significant reduction in the amount of speech. Replies to questions are often very brief, and lack detail.	0: Absent. 1: Occasional replies are unelaborated. 2: Some replies are monosyllabic and brief and do not contain sufficient detail. 3: Most answers are telegraphic (only a few words) and questions are often left unanswered. 4: Essentially mute.	Yes
Poverty of content of speech	Speech that is vague, too general in content, and that conveys very little meaning.	0: Absent. 1: Occasional replies are too vague or markedly condensed. 2: ¼ of the interview is marked by vague and/or condensed speech. 3: ½ of the interview is marked by vague and/or condensed speech that is incomprehensible. 4: Most of the interview is vague, incomprehensible and/or markedly condensed.	Yes
Pressure of speech	Speech that is atypically fast. Speaker makes very few pauses and is very difficult to interrupt.	0: Absent. 1: Some slight increase in amount, speed, and loudness. 2: Several minutes to answer simple questions, loud and fast pace 3: 3 minutes to answer a simple question, or starts talking without social stimulation, and/or difficult to interrupt. 4: Talks continually with very little interruption, and/or shouts to drown out the speech of others.	Yes
Distractible speech	The topic of speech is abruptly interrupted and swapped by a topic triggered by stimuli in the immediate environment.	0: Absent. 1: Distracted once during the interview. 2: Distracted 2-4 times during the interview. 3: Distracted 5-10 times during the interview. 4: Distracted ≥10 times during the interview.	Yes

* Item score is multiplied by 2.

Derailment	An unpredictable pattern of speech in which speaker abruptly wanders off onto different and unrelated topics.	0: Absent. 1: One instance during the interview. 2: 2-4 instances during the interview. 3: 5-10 instances during the interview. 4: ≥10 instances, or interview is overall incomprehensible.	Yes
Tangentiality	The speaker replies to a question in a way that is only vaguely related to the question.	0: Absent. 1: One instance during the interview. 2: 2-4 instances during the interview. 3: 5-10 instances during the interview. 4: ≥10 instances, or interview is overall incomprehensible.	Yes
Incoherence	A pattern of speech that is incoherent and unintelligible.	0: Absent. 1: One instance during the interview. 2: 2-4 instances during the interview. 3: 5-10 instances during the interview. 4: ≥10 instances, or interview is overall incomprehensible.	Yes
Illogicality	A pattern of speech marked by inferences that are illogical.	0: Absent. 1: One instance during the interview. 2: 2-4 instances during the interview. 3: 5-10 instances during the interview. 4: ≥10 instances, or interview is overall incomprehensible.	Yes
Clanging	A pattern of speech in which words are associated by their phonological resemblance rather than their meaning.	0: Absent. 1: One instance during the interview. 2: 2-4 instances during the interview. 3: 5-10 instances during the interview. 4: ≥10 instances, or interview is overall incomprehensible.	Yes
Neologisms	Newly created word that does not have a socially accepted meaning and therefore is unknown to the listener.	0: Absent. 1: One neologism during the interview. 2: 2-4 neologisms during the interview. 3: ≥5 neologisms during the interview.	Yes

Word approximations	Words that are used in an unconventional and idiosyncratic way.	0: Absent. 1: One instance during the interview. 2: 2-4 instances during the interview. 3: ≥5 instances during the interview.	Yes
Circumstantiality	A pattern of speech that is delayed getting to the point and that is marked by excessive and irrelevant details.	0: Absent. 1: Occurs occasionally but can get to the point if prompted. 2: Several instances of circunstaciality, cannot get to the point when prompted, or single replies of 5 minutes. 3: Many circumstantial replies and descriptions, usually continues when prompted or interrupted, or single replies of 15 minutes.	No
Loss of goal	Pattern of speech in which thoughts don't follow into a conclusion and ideas are left pending without closure.	0: Absent. 1: One failure to follow topic through to a logical conclusion during the interview. 2: 2-4 failures during the interview. 3: ≥5 failures during the interview.	No
Perseveration	One word and idea are persistently repeated in an irrelevant and decontextualized way.	0: Absent. 1: Repetition of one set of words or ideas. 2: Repetition of 2-3 sets of words or ideas. 3: Repetition of ≥4 set of words or ideas..	No
Blocking	The abrupt and complete interruption of the flow of speech that can last for seconds or minutes. After the interruption, speaker is unable to return to original idea.	0: Absent. 1: Occurs once during the interview. 2: 2-4 times during the interview. 3: ≥5 during the interview.	No
Echolalia	Speaker mechanically echoes the last words or sentence of the interviewer without any apparent communicational intent.	0: Absent. 1: Occurs once during the interview. 2: 2-4 times during the interview. 3: ≥5 during the interview.	No

Stilted speech	A pattern of speech that is stilted and marked by excessive formality for the social context.	0: Absent. 1: 1-2 instances. 2: Frequent instances. 3: Most answers are stilted.	No
Self-reference	The speaker repeatedly answers questions by bringing up unrelated personal concerns, worries, and themes.	0: Absent. 1: Occurs once in 15-min. 2: 2-4 times in 15-min. 3: ≥5 in 15-min.	No

Scale for the assessment of thought, language and communication (TLC)

ID: _____ Interview: Neutral/Salient

TLC items	0	1	2	3	4
Poverty of speech					
Poverty of content of speech					
Pressure of speech					
Distractible speech					
Tangentiality					
Derailment					
Incoherence					
Illogicality					
Clanging					
Neologisms					
Word approximations					
Circumstantiality					
Loss of goal					
Perseveration					
Echolalia					
Blocking					
Stilted speech					
Self-reference					
Phonemic paraphasia					
Semantic paraphasia					
Global rating					

Appendix P. Lubben's Social Network Scale (LSNS-18)

FAMILY: Considering the people to whom you are related by birth, marriage, adoption, etc.

1. How many relatives do you see or hear from at least once a month?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

2. How often do you see or hear from relative with whom you have the most contact?

0= less than monthly 1= monthly 2= few times a month 3= weekly 4= few times a week 5= daily

3. How many relatives do you feel at ease with that you can talk about private matters?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

4. How many relatives do you feel close to such that you could call on them for help?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

5. When one of your relatives has an important decision to make, how often do they talk to you about it?

0= never 1= seldom 2= sometimes 3= often 4= very often 5= always

6. How often is one of your relatives available for you to talk to when you have an important decision to make?

0= never 1= seldom 2= sometimes 3= often 4= very often 5= always

NEIGHBOURS: Considering those people who live in your neighbourhood...

7. How many of your neighbours do you see or hear from at least once a month?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

8. How often do you see or hear from the neighbour with whom you have the most contact?

0= less than monthly 1= monthly 2= few times a month 3= weekly 4= few times a week 5= daily

9. How many neighbours do you feel at ease with that you can talk about private matters?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

10. How many neighbours do you feel close to such that you could call on them for help?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

11. When one of your neighbours has an important decision to make, how often do they talk to you about it?

0= never 1= seldom 2= sometimes 3= often 4= very often 5= always

12. How often is one of your neighbours available for you to talk to when you have an important decision to make?

0= never 1= seldom 2= sometimes 3= often 4= very often 5= always

FRIENDSHIPS: Considering your friends who do not live in your neighbourhood…

13. How many of your friends do you see or hear from at least once a month?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

14. How often do you see or hear from the friend with whom you have the most contact?

0= less than monthly 1= monthly 2= few times a month 3= weekly 4= few times a week 5= daily

15. How many friends do you feel at ease with that you can talk about private matters?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

16. How many friends do you feel close to such that you could call on them for help?

0= none 1= one 2= two 3= three or four 4= five thru eight 5= nine or more

17. When one of your friends has an important decision to make, how often do they talk to you about it?

0= never 1= seldom 2= sometimes 3= often 4= very often 5= always

18. How often is one of your friends available for you to talk to when you have an important decision to make?

0= never 1= seldom 2= sometimes 3= often 4= very often 5= always

Total score

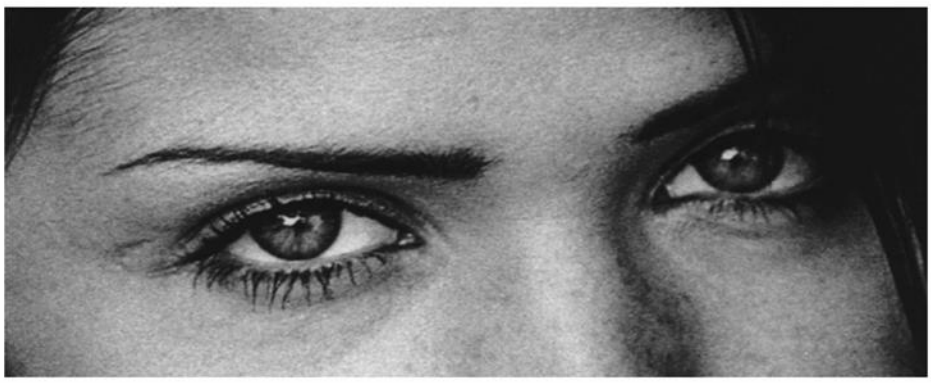
Appendix Q. Reading the Mind in the Eyes test (stimuli)

Practice

1

2

3



4

5

6

7

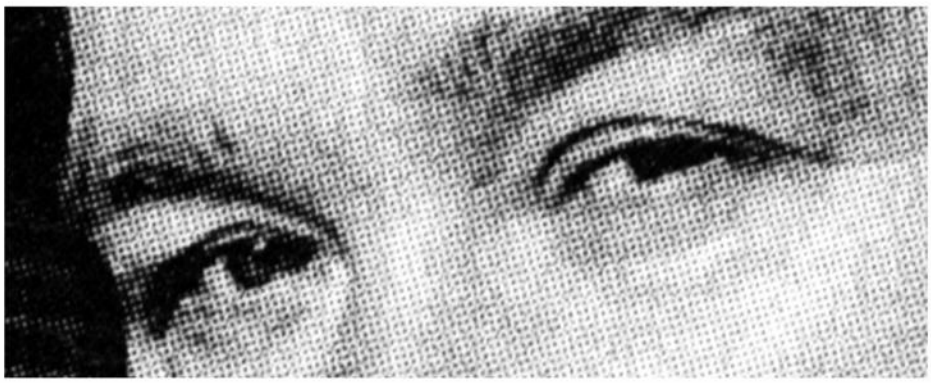
8

9

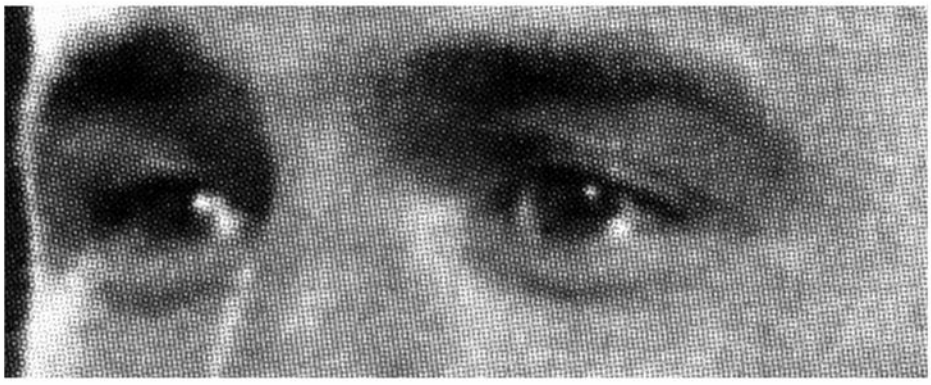
10

11

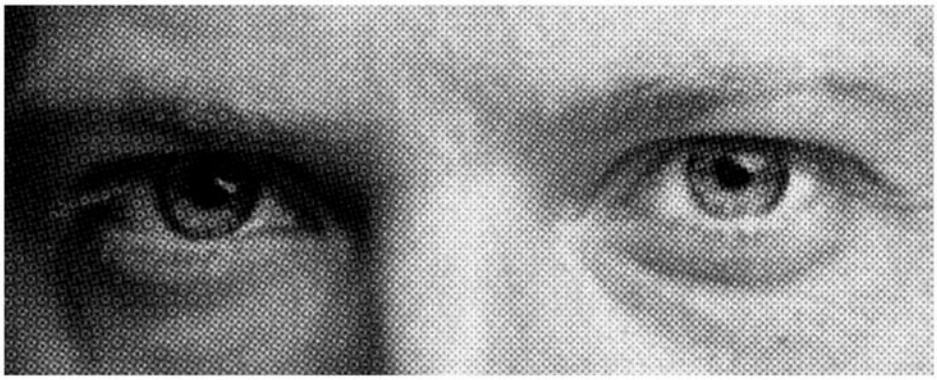
12



13



14



15

16

17

18

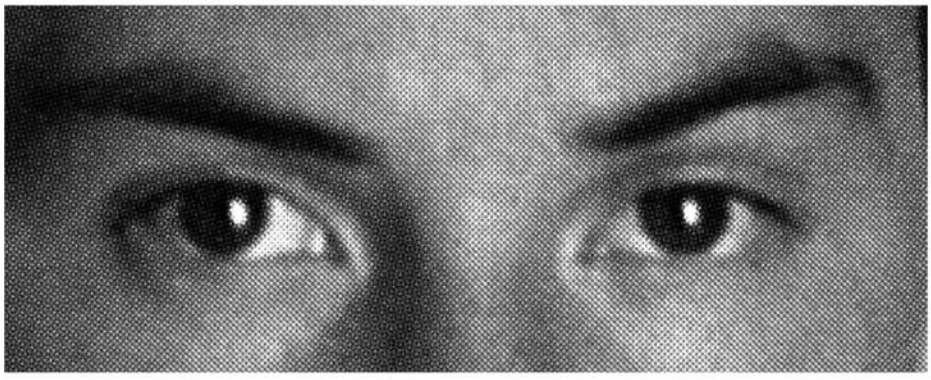
19

20

21

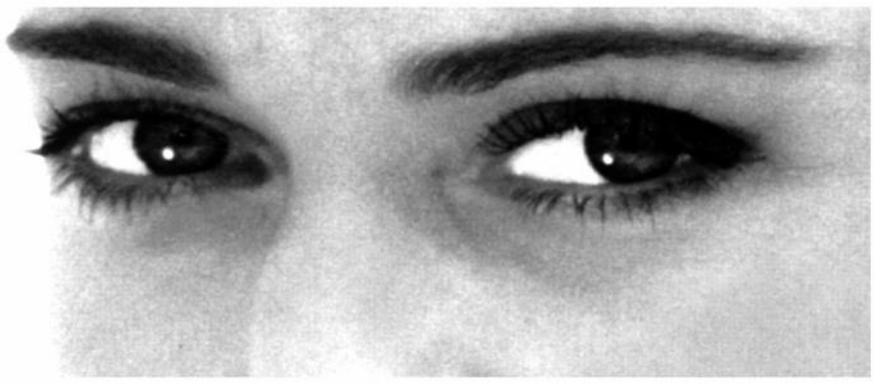
22

23

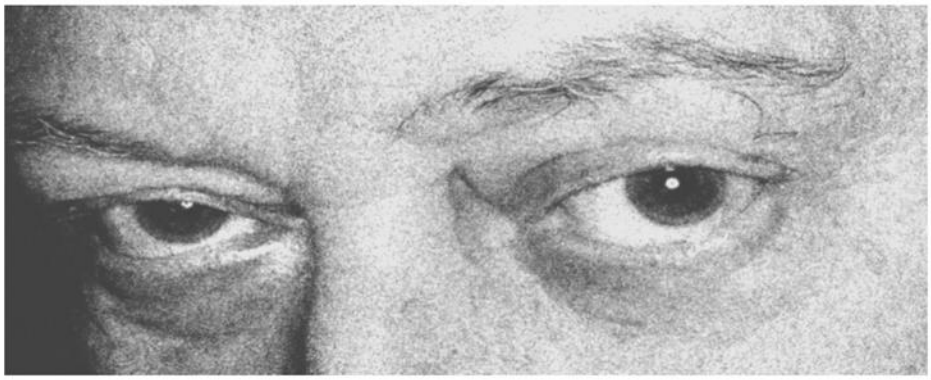


24

25



26



27

28

29

30

31

32

33

34

35

36

Appendix R. Reading the Mind in the Eyes test (instructions)

Adult Eyes Instructions

For each set of eyes, choose and circle which word best describes what the person in the picture is thinking or feeling. You may feel that more than one word is applicable but please choose just one word, the word, which you consider to be most suitable. Before making your choice, make sure that you have read all 4 words. You should try to do the task as quickly as possible but you will not be timed. If you really don't know what a word means you can look it up in the definition handout.

Record Sheet

Date of Birth:..... T oday's date:.....

Degree subject/occupation:.....

P	jealous	panicked	arrogant	hateful
1	playful	comforting	irritated	bored
2	terrified	upset	arrogant	annoyed
3	joking	flustered	desire	convinced
4	joking	insisting	amused	relaxed
5	irritated	sarcastic	worried	friendly
6	aghast	fantasizing	impatient	alarmed
7	apologetic	friendly	uneasy	dispirited
8	despondent	relieved	shy	excited
9	annoyed	hostile	horrified	preoccupied
10	cautious	insisting	bored	aghast
11	terrified	amused	regretful	flirtatious
12	indifferent	embarrassed	sceptical	dispirited
13	decisive	anticipating	threatening	shy
14	irritated	disappointed	depressed	accusing
15	contemplative	flustered	encouraging	amused
16	irritated	thoughtful	encouraging	sympathetic
17	doubtful	affectionate	playful	aghast
18	decisive	amused	aghast	bored
19	arrogant	grateful	sarcastic	tentative
20	dominant	friendly	guilty	horrified
21	embarrassed	fantasizing	confused	panicked
22	preoccupied	grateful	insisting	imploring
23	contented	apologetic	defiant	curious
24	pensive	irritated	excited	hostile
25	panicked	incredulous	despondent	interested
26	alarmed	shy	hostile	anxious
27	joking	cautious	arrogant	reassuring
28	interested	joking	affectionate	contented
29	impatient	aghast	irritated	reflective
30	grateful	flirtatious	hostile	disappointed
31	ashamed	confident	joking	dispirited
32	serious	ashamed	bewildered	alarmed
33	embarrassed	guilty	fantasizing	concerned
34	aghast	baffled	distrustful	terrified
35	puzzled	nervous	insisting	contemplative
36	ashamed	nervous	suspicious	indecisive

		Answers - Adults			
P	jealous	**panicked**	arrogant	hateful	**M**
1	**playful**	comforting	irritated	bored	**M**
2	terrified	**upset**	arrogant	annoyed	**M**
3	joking	flustered	**desire**	convinced	**F**
4	joking	**insisting**	amused	relaxed	**M**
5	irritated	sarcastic	**worried**	friendly	**M**
6	aghast	**fantasizing**	impatient	alarmed	**F**
7	apologetic	friendly	**uneasy**	dispirited	**M**
8	**despondent**	relieved	shy	excited	**M**
9	annoyed	hostile	horrified	**preoccupied**	**F**
10	**cautious**	insisting	bored	aghast	**M**
11	terrified	amused	**regretful**	flirtatious	**M**
12	indifferent	embarrassed	**sceptical**	dispirited	**M**
13	decisive	**anticipating**	threatening	shy	**M**
14	irritated	disappointed	depressed	**accusing**	**M**
15	**contemplative**	flustered	encouraging	amused	**F**
16	irritated	**thoughtful**	encouraging	sympathetic	**M**
17	**doubtful**	affectionate	playful	aghast	**F**
18	**decisive**	amused	aghast	bored	**F**
19	arrogant	grateful	sarcastic	**tentative**	**F**
20	dominant	**friendly**	guilty	horrified	**M**
21	embarrassed	**fantasizing**	confused	panicked	**F**
22	**preoccupied**	grateful	insisting	imploring	**F**
23	contented	apologetic	**defiant**	curious	**M**
24	**pensive**	irritated	excited	hostile	**M**
25	panicked	incredulous	despondent	**interested**	**F**
26	alarmed	shy	**hostile**	anxious	**M**
27	joking	**cautious**	arrogant	reassuring	**F**
28	**interested**	joking	affectionate	contented	**F**
29	impatient	aghast	irritated	**reflective**	**F**
30	grateful	**flirtatious**	hostile	disappointed	**F**
31	ashamed	**confident**	joking	dispirited	**F**
32	**serious**	ashamed	bewildered	alarmed	**M**
33	embarrassed	guilty	fantasizing	**concerned**	**M**
34	aghast	baffled	**distrustful**	terrified	**F**
35	puzzled	**nervous**	insisting	contemplative	**F**
36	ashamed	nervous	**suspicious**	indecisive	**M**

Appendix S. Hinting task

Instructions.

I'm going to read out a set of 10 stories involving two people. Each story ends with one of the characters saying something. When I've read the stories out I'm going to ask you some questions about what the character said.

Here's the first story. Listen carefully to it.

Name:_____Sex:_____Age:_____Quick:

Story	**Verbatim Response 1 and score**	**Verbatim Response 2 and score**
long, hot journey		
dirty bath		
treacle toffees		
creased shirt		
flat broke!		
project at work		
birthday present		
ornaments		
train set		
heavy cases		

Scoring

George arrives in Angela's office after a long and hot journey down the motorway. Angela immediately begins to talk about some business ideas. George interrupts Angela saying:

"My, my! It was a long, hot journey down that motorway!"

QUESTION: What does George really mean when he says this?

Answer: George means either “Can I have a drink” and/or “Can I have a few minutes to settle down after my journey before we start talking business”. Either of these responses would score 2.

If a correct response is not give for the first hint (eg. the participant just replies something like “He means exactly what he says”) then introduce next part of the story / hint.

ADD: George goes on to say:
"I'm parched!"

QUESTION: What does George want Angela to do?

Answer: George wants Angela to get him or offer to get him a drink. This response would score 1. Anything else would be given a score of 0.

Melissa goes to the bathroom for a shower. Anne has just had a bath. Melissa notices the bath is dirty so she calls upstairs to Anne:

"Couldn't you find the Ajax, Anne?"

QUESTION: What does Melissa really mean when she says this?

Answer: Melissa means “Why didn’t you clean out the bath” or “Go and clean out the bath now”. This response would be given a score of 2 and next item would be introduced

If the participant fails to give the correct answer at this stage then:

ADD: Melissa goes on to say:

"You're very lazy sometimes, Anne!"

QUESTION: What does Melissa want Anne to do?

Answer: Melissa wants Anne to clean out the bath. This response would score 1. Any other response would be given a score of 0.

Gordon goes to the supermarket with his mum. They arrive at the sweetie aisle. Gordon says:

"Cor! Those treacle toffees look delicious."

QUESTION: What does Gordon really mean when he says this?

Answer: Gordon means “Please buy me some sweets, mum”

ADD: Gordon goes on to say:
"I'm hungry, mum."

QUESTION: What does Gordon want his mum to do?

Answer: Buy him some sweets.

Paul has to go to an interview and he's running late. While he is cleaning his shoes, he says to his wife, Jane:

"I want to wear that blue shirt but it's very creased."

QUESTION: What does Paul really mean when he says this?

Answer: Paul means “Will you iron my shirt for me please?”

ADD: Paul goes on to say:
"It's in the ironing basket."

QUESTION: What does Paul want Jane to do?

Answer: Iron his shirt

Lucy is broke but she wants to go out in the evening. She knows that David has just been paid. She says to him:

"I'm flat broke! Things are so expensive these days."

QUESTION: What does Lucy really mean when she says this?

Answer: Lucy means “Will you lend me some money David?” OR “Will you take me out tonight and pay?”

ADD: Lucy goes on to say:
"Oh well, I suppose I'll have to miss my night out."

QUESTION: What does Lucy want David to do?

Answer: She wants David to lend her money or offer to take her out and pay.

Donald wants to run a project at work but Richard, his boss, has asked someone else to run it. Donald says:

"What a pity. I'm not too busy at the moment."

QUESTION: What does Donald really mean when he says this?

Answer: Donald means " Please change your mind Richard and give the project to me"

ADD: Donald goes on to say:
"That project is right up my street."

QUESTION: What does Donald want Richard to do?

Answer: Change his mind and give the project to him to run

Rebecca's birthday is approaching. She says to her Dad:

"I love animals, especially dogs."

QUESTION: What does Rebecca really mean when she says this?

Answer: “Will you buy me a dog for my birthday Dad?”

ADD: Rebecca goes on to say:
"Will the pet shop be open on my birthday, Dad?"

QUESTION: What does Rebecca want her dad to do?

Answer: to say he’ll buy her a dog for her birthday/ buy her a dog for her birthday

Betty and Michael moved into their new house a week ago. Betty has been unpacking some ornaments. She says to Michael:

"Have you unpacked those shelves we bought, Michael?"

QUESTION: What does Betty really mean when she says this?

Answer: Betty means “Will you put those shelves up now please?”

ADD: Betty goes on to say:

"If you want something doing you have to do it yourself!"

QUESTION: What does Betty want Michael to do?

Answer: Put the shelves up.

Jessica and Max are playing with a train set. Jessica has the blue train and Max has the red one. Jessica says to Max:

"I don't like this train."

QUESTION: What does Jessica really mean when she says this?

Answer: Jessica means “I want your train and you can have mine.”

ADD: Jessica goes on to say:
"Red is my favourite colour."

QUESTION: What does Jessica want Max to do?

Answer: swap trains

Patsy is just getting off the train with three heavy cases. John is standing behind her. Patsy says to John:

"Gosh! These cases are a nuisance."

QUESTION: What did Patsy really mean when she said this?

Answer: Patsy means “Would you help me with my luggage please”

ADD: Patsy goes on to say:
"I don't know if I can manage all three."

QUESTION: What does Patsy want John to do?

Answer: help her with her cases.

Appendix T. Power calculation

In order to estimate sample size for mediation analysis, we carried out a power analysis on G*Power 3.1 software. The analysis was based on a multiple linear regression model with the following parameters: medium effect-size (f^2= .15), and α error probability of .05, a standard power of .80 and 2 predictors. The analysis yielded an estimated sample size of 68 participants for the study to be appropriately powered.

Appendix U. Research Review Committee (RRC)

D.Clin.Psychology Programme
Division of Clinical Psychology
Whelan Building, Quadrangle
Brownlow Hill
LIVERPOOL
L69 3GB

Tel: 0151 794 5530/5534/5877
Fax: 0151 794 5537
www.liv.ac.uk/dclinpsychol

05/07/2016

Paulo de Sousa
Trainee Clinical Psychologist
Doctorate of Clinical Psychology Programme
University of Liverpool
L69 3GB

RE: Testing the role of social isolation and social cognition in thought disorder

Dear *Paulo*,

Thank you for our response to the reviewers' comments of your research proposal submitted to the Chair of the D.Clin.Psychol. Research Review Committee (version 2, *dated 18/06/2016*).

I can now confirm that your amended proposal meet the requirements of the committee and have been approved by the Committee Chair.

Please take this Chairs Action decision as ***final*** approval from the committee.

You may now progress to the next stages of your research.

I wish you well with your research project.

Dr Peter Taylor
Vice-Chair, DClinPsychol Research Committee

Appendix V. University sponsorship approval letter

Professor Bentall
Department of Psychological Sciences
University of Liverpool
Room 1.08, Eleanor Rathbone Building
Liverpool
L69 7ZA

Mr Alex Astor
Head of Research Support – Health and Life Sciences

University of Liverpool
Research Support Office
2nd Floor Block D Waterhouse Building
3 Brownlow Street
Liverpool
L69 3GL

Tel: 0151 794 8739
Email: sponsor@liv.ac.uk

08 November 2016

Sponsor Ref: UoL001239

Re: Sponsor Permission to Proceed notification

"Testing the role of social isolation and social cognition in thought disorder"

Dear Professor Bentall

All necessary documentation and regulatory approvals have now been received by the University of Liverpool Research Support Office in its capacity as Sponsor, and we are satisfied that all Clinical Research Governance requirements have been met. You may now proceed with any study specific procedures to open the study.

The following REC Approved documents have been received by the Research Support Office. Only these documents can be used in the recruitment of participants. If any amendments are required please contact the Research Support Office.

Document title	Version	Date
Research protocol	1.1	18 June 2016
Participant information sheet (PIS)	1.2	28 September 2016
Participant consent form	1.1	01 August 2016
Debrief sheet (script)	1.1	30 September 2016
Inclusion and exclusion criteria	No version	01 September 2016
Validated questionnaire [Lubben's Social Network Scale (LSNS)]	No version	No date
Validated questionnaire [Hinting Task]	No version	No date
Validated questionnaire [Eyes test instructions]	No version	No date
Interview schedules or topic guides for participants [PANSS items]	No version	No date

Please note, under the terms of your Sponsorship you must;

1. Gain NHS Confirmation of Capacity and Capability from each participating site before recruitment begins at that site;

2. Ensure all required contracts are fully executed before recruitment begins at any site;

3. Inform the Research Support Office as soon as possible of any adverse events especially SUSARs and SAE's, Serious Breaches to protocol or relevant legislation or any concerns regarding research conduct;

4. Approval must be gained from the Research Support Office for any amendments to, or changes of status in the study **prior to** submission to REC and any other regulatory authorities;

5. It is a requirement that Annual Progress Reports are sent to the NHS Research Ethics Committee (REC) annually following the date of Favourable Ethical Approval. You must provide copies of any reports submitted to REC and other regulatory authorities to the Research Support Office;

6. Maintain the study master file;

7. Make available for review any study documentation when requested by the sponsors and regulatory authorities for the purposes of audit or inspection;

8. Upon the completion of the study it is a requirement to submit an End of Study Declaration (within 90 days of the end of the study) and End of Study Report to REC (within 12 months of the end of the study). You must provide copies of this to the Research Support Office;

9. Ensure you and your study team are up to date with the current RSO SOPs throughout the duration of the study.

If you have any queries regarding the sponsorship of the study please do not hesitate to contact the Clinical Research Governance Team on 0151 794 8373 (email sponsor@liv.ac.uk).

Yours sincerely

Mr Alex Astor
Head of Research Support – Health and Life Sciences
Research Support Office

Appendix X. Ethics and RD correspondence

NHS
Health Research Authority
North West - Liverpool East Research Ethics Committee
Barlow House
3rd Floor
4 Minshull Street
Manchester
M1 3DZ

Telephone: 02071048127

28 September 2016

Dr Paulo Alexandre Brito de Sousa
Department of Psychological Sciences
University of Liverpool, Whelan Building, The Quadrangle Brownlow Hill
Liverpool
L69 3GB

Dear Dr de Sousa

Study Title:	**Testing the role of social isolation and social cognition in thought disorder**
REC reference:	**16/NW/0647**
Protocol number:	**UoL001239**
IRAS project ID:	**211422**

The Research Ethics Committee reviewed the above application at the meeting held on 15 September 2016. Thank you for attending to discuss the application.

Provisional opinion

The Committee is unable to give an ethical opinion on the basis of the information and documentation received so far. Before confirming its opinion, the Committee requests that you provide the further information set out below.

Authority to consider your response and to confirm the Committee's final opinion has been delegated to the Chair along with the Lead Reviewer.

Further information or clarification required

1) **Please provide the following:**
   i. Look into the availability of the debrief card and provide a copy to the Committee
   ii. Remove any reference to contacting the participants GP from the study
   iii. Provide feedback on the Open Access criteria of access to the study data at University of Liverpool.

2) **Additions and Amendments to the Participant Information Sheet**
   i. Point 6 Replace the wording 'The only potential risk is related to distress' with 'You may experience distress when we discuss your mental health difficulties'
   ii. Point 7 Rephrase the wording to 'There is no direct benefit for you but we hope that your involvement will help future service users'.
   iii. Please check the document for typographical errors

The Committee considered that the hinting test contained quite dated language. The Committee was aware that you cannot alter this (as it is validated) but wanted to ensure you were aware of this.

If you would find it helpful to discuss any of the matters raised above or seek further clarification from a member of the Committee, you are welcome to contact Matt Rogerson.

When submitting a response to the Committee, the requested information should be electronically submitted from IRAS. A step-by-step guide on submitting your response to the REC provisional opinion is available on the HRA website using the following link: http://www.hra.nhs.uk/nhs-research-ethics-committee-rec-submitting-response-provisional-opinion/

Please submit revised documentation where appropriate underlining or otherwise highlighting the changes which have been made and giving revised version numbers and dates. You do not have to make any changes to the REC application form unless you have been specifically requested to do so by the REC.

The Committee will confirm the final ethical opinion within a maximum of 60 days from the date of initial receipt of the application, excluding the time taken by you to respond fully to the above points. A response should be submitted by no later than 28 October 2016.

Summary of the discussion at the meeting

You were welcomed to the meeting and had no objections to the observer being present

Social or scientific value; scientific design and conduct of the study

The Committee noted that interviews would take place in either the participant's home or at an NHS site and asked where specifically on NHS sites they would be held

You confirmed the majority of interviews (98%) would be held within the home environment. A lab would be available within Liverpool University but this would not be the safest place and would require risk assessment. In addition, there would be lots of rooms available within the Early Intervention site.

The Committee asked what would be the primary and secondary outcomes for the study

You confirmed the primary outcome was the building of the thought model and the secondary outcome would be the discovery of whether social isolation and social-cognitive variables were significantly associated with thought disorder.

The Committee queried why the hinting test had been chosen

You advised you had reviewed all relevant tools and selected the hinting test as it had the best results and options.

The Committee queried the language used on the hinting test as some of the language used was somewhat dated.

You agreed to look at the language.

The Committee queried why you intended to contact the participant's GP and suggested this could be removed from the study.

You agreed not to contact the GP and would remove this section from the study.

Recruitment arrangements and access to health information, and fair participant selection

The Committee ask how potential participants would be identified.

You stated that Care Coordinators, Care Teams, Nurses and Clinical Psychologists would be asked for potential recruits by way of a presentation, given by the Chief Investigator.

The Committee queried if these staff members had already been identified

You confirmed staff members had been identified at Mersey Care but not within the 5 Boroughs area at that time.

The Committee asked what the minimum number of participants would be needed.

You advised this would be 68 to be on the safe side however the study could run with 50-55 participants. You further stated that a previous similar study had recruited 120 participants over a short period of time.

The Committee noted that referrals would take place from three different places but this information was not consistent

You agreed but stated that this intention was to include all Health Care Providers.

Care and protection of research participants; respect for potential and enrolled participants' welfare and dignity

The Committee asked if the undergraduate carrying out the coding of the data would be part of the study team

You confirmed that the undergraduate would not be part of the study team but that all data would be anonymised before analysis

The Committee noted that you planned to debrief following the interview and asked if there would be a script available.

You confirmed no script would be available.

The Committee stated that a debrief script had been seen before for a similar study and asked if you would have access to a similar script.

You were not aware of a script but would look into this and feedback to Committee

The Committee suggested using the signposting card which could be available at Mersey Health

You were not aware of the 'signposting card' at Mersey Health but would look into this and feedback to Committee

The Committee queried what would happen if a participant became distressed during the interview.

You advised that it would depend on the level of distress experienced by the participant. You would discontinue the discussions and contact the Care Coordinator. If you were unable to maintain the distress, you would signpost to Emergency Services and/or the Mental Health Crisis Team.

The Committee thanked you for this response and further queried if the Care Team would be around if the interview was carried out within an NHS setting.

You confirmed that only you and the participant would be present at interviews held within a NHS setting.

The Committee expressed concern that other people e.g. auditors would have access to the study data at NHS sites especially where the Open Access criteria was a standard statement, for example at the University of Liverpool.

You were not aware but agreed to look into this and feedback to Committee.

Informed consent process and the adequacy and completeness of participant information

The Committee asked how participants would be assessed as having the capacity to consent to participate in the study

You confirmed that this would take place in two ways, either by discussions with the Care Coordinator or by the Chief Investigator self, as he had previous experience in assessing capacity. Each participant would be given at least one week to consider taking part and would be encouraged to discuss with the family, carers and support workers to make an informed decision.

The Committee asked that the wording in the Participant Information Sheet 'The only potential risk is related to distress' be replaced with 'You may experience distress when we discuss your mental health difficulties'

You agreed to make this change

The Committee considered that there would be no direct benefit to participants and asked that

the Participant Information Sheet be rephrased to ‘There is no direct benefit for you but we hope that your involvement will help future service users.

You agreed to make this change

Other general comments

The Committee were pleased to see that Service Users feedback had been garnered for the study and asked the researcher to provide further detail

You confirmed that a panel of experts by experience, called the LEXI Group, had provided comments on the study and had also provided suggestions on the statistical aspects, too.

You had no questions for the Committee.

Documents reviewed

The documents reviewed at the meeting were:

Document	*Version*	*Date*
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Insurance cover]		
Interview schedules or topic guides for participants [PANSS items]		
IRAS Application Form [IRAS_Form_15082016]		15 August 2016
IRAS Application Form XML file [IRAS_Form_15082016]		15 August 2016
IRAS Checklist XML [Checklist_15082016]		15 August 2016
IRAS Checklist XML [Checklist_05092016]		05 September 2016
Letter from sponsor [Sponsorship approval]		
Other [Merseycare Statement of Activities]		
Other [Merseycare Schedule of Events]		
Other [CWP Statement of Activities]		
Other [CWP Schedule of Events]		
Other [5 Boroughs Statement of Activities]		
Other [5 Boroughs Schedule of Events]		
Other [Lancashire Care Statement of Activities]		
Other [Lancashire Care Schedule of Events]		
Other [Inclusion and exclusion criteria]		01 September 2016
Participant consent form [Participant consent form]	1.1	01 August 2016
Participant information sheet (PIS) [Participant information sheet]	1.1	01 August 2016
Referee's report or other scientific critique report [Referee approval]		
Research protocol or project proposal [Protocol]	1.1	18 June 2016
Summary CV for Chief Investigator (CI) [CI brief CV]		
Summary CV for Chief Investigator (CI) [William Sellwood CV]		
Summary CV for student [Student brief CV]		
Validated questionnaire [Lubben's Social Network Scale (LSNS)]		

Validated questionnaire [Hinting Task]		
Validated questionnaire [Eyes test instructions]		

Membership of the Committee

The members of the Committee who were present at the meeting are listed on the attached sheet

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

16/NW/0647	**Please quote this number on all correspondence**

Yours sincerely

Signed on behalf of
Mrs Glenys J Hunt
Chair

Email: nrescommittee.northwest-liverpooleast@nhs.net

Enclosures: *List of names and professions of members who were present at the meeting and those who submitted written comments.*

Copy to: *Mr Alex Astor*
Professor Richard Bentall
Ms Pauline Parker, Mersey Care NHS Foundation Trust

North West - Liverpool East Research Ethics Committee

Attendance at Committee meeting on 15 September 2016

Committee Members:

Name	*Profession*	*Present*	*Notes*
Mr John Bridson	Clinical Ethicist	No	
Mrs Sue Fitzpatrick	Director	Yes	
Mrs Elizabeth Gordon	Retired Magistrate	Yes	
Mrs Maureen Hendry	Pharmacist	Yes	
Mrs Glenys J Hunt	Solicitor	Yes	
Dr Supriya Kapas	Senior Clinical Pharmacist	No	
Mr Alan McGarrity	Retired Police Inspector	No	
Mrs Theresa Moorcroft	Paediatric Research Nurse Manager	No	
Mr Alex Newgrosh	Quality Assurance Manager	Yes	
Mr David Powell	Honorary Consultant Clinical Psychologist	Yes	
Mr Matthew Rogerson	REC Manager	No	
Miss Kimberley Saint	Clinical Scientist - Nuclear Medicine	Yes	
Mrs Julia Waddon	Advanced Nurse Practitioner	Yes	
Dr Peter Walton	Retired Lay Member	Yes	

Health Research Authority
North West - Liverpool East Research Ethics Committee
Barlow House
3rd Floor
4 Minshull Street
Manchester
M1 3DZ

Telephone: 02071048127

Please note: This is an acknowledgement letter from the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval

06 October 2016

Dr Paulo Alexandre Brito de Sousa
Department of Psychological Sciences
University of Liverpool, Whelan Building, The Quadrangle Brownlow Hill
Liverpool
L69 3GB

Dear Dr de Sousa

Study title:	**Testing the role of social isolation and social cognition in thought disorder**
REC reference:	**16/NW/0647**
Protocol number:	**UoL001239**
IRAS project ID:	**211422**

Thank you for your letter of 6 October 2016. I can confirm the REC has received the documents listed below and that these comply with the approval conditions detailed in our letter dated 06 October 2016.

Documents received

The documents received were as follows:

Other [Debrief sheet]	1.2	06 October 2016

Approved documents

The final list of approved documentation for the study is therefore as follows:

Document	*Version*	*Date*
Covering letter on headed paper [Letter with reply to Ethics]		30 September 2016
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Insurance cover]		
Interview schedules or topic guides for participants [PANSS items]		
IRAS Application Form [IRAS_Form_15082016]		15 August 2016
Other [Inclusion and exclusion criteria]		01 September 2016
Other [Debrief sheet]	1.2	06 October 2016
Participant consent form [Participant consent form]	1.1	01 August 2016
Participant information sheet (PIS) [Participant information sheet]	1.2	28 September 2016
Referee's report or other scientific critique report [Referee approval]		
Research protocol or project proposal [Protocol]	1.1	18 June 2016
Response to Additional Conditions Met		06 October 2016
Summary CV for Chief Investigator (CI) [CI brief CV]		
Summary CV for Chief Investigator (CI) [William Sellwood CV]		
Summary CV for student [Student brief CV]		
Validated questionnaire [Lubben's Social Network Scale (LSNS)]		
Validated questionnaire [Hinting Task]		
Validated questionnaire [Eyes test instructions]		

You should ensure that the sponsor has a copy of the final documentation for the study. It is the sponsor's responsibility to ensure that the documentation is made available to R&D offices at all participating sites.

16/NW/0647 **Please quote this number on all correspondence**

Yours sincerely

Matt Rogerson
REC Manager

E-mail: nrescommittee.northwest-liverpooleast@nhs.net

Copy to: *Dr Richard Bentall*
Ms Pauline Parker, Mersey Care NHS Foundation Trust

Health Research Authority

North West - Liverpool East Research Ethics Committee
Barlow House
3rd Floor
4 Minshull Street
Manchester
M1 3DZ

Telephone: 02071048127

Please note: This is the favourable opinion of the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval

06 October 2016

Dr Paulo Alexandre Brito de Sousa
Department of Psychological Sciences
University of Liverpool, Whelan Building, The Quadrangle Brownlow Hill
Liverpool
L69 3GB

Dear Dr de Sousa

Study title:	**Testing the role of social isolation and social cognition in thought disorder**
REC reference:	**16/NW/0647**
Protocol number:	**UoL001239**
IRAS project ID:	**211422**

Thank you for your letter of response to the Committee's request for further information on the above research, and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to make a request to postpone publication, please contact the REC Manager, Matt Rogerson, nrescommittee.northwest-liverpooleast@nhs.net.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Conditions of the favourable opinion

The REC favourable opinion is subject to the following conditions being met prior to the start of the study.

1. The Debrief Sheet should be revised to specify the following information:

    a. "The nature of the questionnaire/interview is not meant to be distressing in any way. However, if the questionnaire/interview leads to distress, unpleasant memories or thoughts, we would encourage you to contact your General Practitioner. You may also wish to contact an independent mental health support group, which does not require referral from a doctor or a nurse, such as the service(s) listed below."

    b. Contact details for an appropriate, 24 hour mental health service, as per your statement in question A22 of the IRAS form.

    c. The above two items should be displayed together, in a prominent place in the debrief sheet.

Management permission must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements. Each NHS organisation must confirm through the signing of agreements and/or other documents that it has given permission for the research to proceed (except where explicitly specified otherwise).

Guidance on applying for NHS permission for research is available in the Integrated Research Application System, www.hra.nhs.uk or at http://www.rdforum.nhs.uk.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of management permissions from host organisations

Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database within 6 weeks of recruitment of the first participant (for medical device studies, within the timeline determined by the current registration and publication trees).

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g. when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non-clinical trials this is not currently mandatory.

If a sponsor wishes to contest the need for registration they should contact Catherine Blewett (catherineblewett@nhs.net), the HRA does not, however, expect exceptions to be made. Guidance on where to register is provided within IRAS.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Ethical review of research sites

NHS sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Non-NHS sites

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
Covering letter on headed paper [Letter with reply to Ethics]		30 September 2016
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Insurance cover]		
Interview schedules or topic guides for participants [PANSS items]		
IRAS Application Form [IRAS_Form_15082016]		15 August 2016
IRAS Application Form XML file [IRAS_Form_15082016]		15 August 2016
IRAS Checklist XML [Checklist_15082016]		15 August 2016
IRAS Checklist XML [Checklist_05092016]		05 September 2016
IRAS Checklist XML [Checklist_03102016]		03 October 2016
Letter from sponsor [Sponsorship approval]		

Other [Merseycare Statement of Activities]		
Other [Merseycare Schedule of Events]		
Other [CWP Statement of Activities]		
Other [CWP Schedule of Events]		
Other [5 Boroughs Statement of Activities]		
Other [5 Boroughs Schedule of Events]		
Other [Lancashire Care Statement of Activities]		
Other [Lancashire Care Schedule of Events]		
Other [Inclusion and exclusion criteria]		01 September 2016
Other [Debrief sheet (script)]	1.1	30 September 2016
Participant consent form [Participant consent form]	1.1	01 August 2016
Participant information sheet (PIS) [Participant information sheet]	1.2	28 September 2016
Referee's report or other scientific critique report [Referee approval]		
Research protocol or project proposal [Protocol]	1.1	18 June 2016
Summary CV for Chief Investigator (CI) [CI brief CV]		
Summary CV for Chief Investigator (CI) [William Sellwood CV]		
Summary CV for student [Student brief CV]		
Validated questionnaire [Lubben's Social Network Scale (LSNS)]		
Validated questionnaire [Hinting Task]		
Validated questionnaire [Eyes test instructions]		

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

The attached document *"After ethical review – guidance for researchers"* gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website:
http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/

HRA Training

We are pleased to welcome researchers and R&D staff at our training days – see details at
http://www.hra.nhs.uk/hra-training/

16/NW/0647	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project.

Yours sincerely

Signed on behalf of
Mrs Glenys J Hunt
Chair

Email:nrescommittee.northwest-liverpooleast@nhs.net

Enclosures: "After ethical review – guidance for researchers" *[SL-AR2]*

Copy to: *Mr Alex Astor*
Professor Richard Bentall
Ms Pauline Parker, Mersey Care NHS Foundation Trust

Health Research Authority

Dr Paulo Alexandre Brito de Sousa
Department of Psychological Sciences
University of Liverpool, Whelan Building, The Quadrangle
Brownlow Hill
Liverpool
L69 3GB

Email: hra.approval@nhs.net

20 October 2016

Dear Dr de Sousa

Letter of HRA Approval

Study title:	**Testing the role of social isolation and social cognition in thought disorder**
IRAS project ID:	**211422**
Protocol number:	**UoL001239**
REC reference:	**16/NW/0647**
Sponsor	**University of Liverpool**

I am pleased to confirm that **HRA Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications noted in this letter.

Participation of NHS Organisations in England

The sponsor should now provide a copy of this letter to all participating NHS organisations in England.

Appendix B provides important information for sponsors and participating NHS organisations in England for arranging and confirming capacity and capability. **Please read *Appendix B* carefully**, in particular the following sections:

- *Participating NHS organisations in England* – this clarifies the types of participating organisations in the study and whether or not all organisations will be undertaking the same activities
- *Confirmation of capacity and capability* - this confirms whether or not each type of participating NHS organisation in England is expected to give formal confirmation of capacity and capability. Where formal confirmation is not expected, the section also provides details on the time limit given to participating organisations to opt out of the study, or request additional time, before their participation is assumed.
- *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* - this provides detail on the form of agreement to be used in the study to confirm capacity and capability, where applicable.

Further information on funding, HR processes, and compliance with HRA criteria and standards is also provided.

It is critical that you involve both the research management function (e.g. R&D office) supporting each organisation and the local research team (where there is one) in setting up your study. Contact details and further information about working with the research management function for each organisation can be accessed from www.hra.nhs.uk/hra-approval.

Appendices

The HRA Approval letter contains the following appendices:

- A – List of documents reviewed during HRA assessment
- B – Summary of HRA assessment

After HRA Approval

The document *"After Ethical Review – guidance for sponsors and investigators",* issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

In addition to the guidance in the above, please note the following:

- HRA Approval applies for the duration of your REC favourable opinion, unless otherwise notified in writing by the HRA.
- Substantial amendments should be submitted directly to the Research Ethics Committee, as detailed in the *After Ethical Review* document. Non-substantial amendments should be submitted for review by the HRA using the form provided on the HRA website, and emailed to hra.amendments@nhs.net.
- The HRA will categorise amendments (substantial and non-substantial) and issue confirmation of continued HRA Approval. Further details can be found on the HRA website.

Scope

HRA Approval provides an approval for research involving patients or staff in NHS organisations in England.

If your study involves NHS organisations in other countries in the UK, please contact the relevant national coordinating functions for support and advice. Further information can be found at http://www.hra.nhs.uk/resources/applying-for-reviews/nhs-hsc-rd-review/.

If there are participating non-NHS organisations, local agreement should be obtained in accordance with the procedures of the local participating non-NHS organisation.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application

procedure. If you wish to make your views known please email the HRA at hra.approval@nhs.net. Additionally, one of our staff would be happy to call and discuss your experience of HRA Approval.

HRA Training

We are pleased to welcome researchers and research management staff at our training days – see details at http://www.hra.nhs.uk/hra-training/

Your IRAS project ID is **211422**. Please quote this on all correspondence.

Yours sincerely

Thomas Fairman
HRA Assessor

Email: hra.approval@nhs.net

Copy to: *Mr Alex Astor, University of Liverpool, (Sponsor Contact)*
Ms Pauline Parker, Mersey Care NHS Foundation Trust, (Lead NHS R&D Contact)
Professor Richard Bentall, University of Liverpool (Chief Investigator)

Appendix A - List of Documents

The final document set assessed and approved by HRA Approval is listed below.

Document	*Version*	*Date*
Covering letter on headed paper [Letter with reply to Ethics]		30 September 2016
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Insurance cover]		
Interview schedules or topic guides for participants [PANSS items]		
IRAS Application Form [IRAS_Form_15082016]		15 August 2016
Letter from sponsor [Sponsorship approval]		
Other [Inclusion and exclusion criteria]		01 September 2016
Other [Debrief sheet]	1.2	06 October 2016
Other [IRAS 211422 Confirmation of non-substantial amendment, 13.10.2016]		13 October 2016
Other [HRA Statement of Activities]	2	20 October 2016
Other [HRA Schedule of Events]	2	20 October 2016
Participant consent form	1.1	01 August 2016
Participant information sheet (PIS)	1.2	28 September 2016
Referee's report or other scientific critique report [Referee approval]		
Research protocol or project proposal [Protocol]	1.1	18 June 2016
Summary CV for Chief Investigator (CI) [CI brief CV]		
Summary CV for Chief Investigator (CI) [William Sellwood CV]		
Summary CV for student [Student brief CV]		
Validated questionnaire [Lubben's Social Network Scale (LSNS)]		
Validated questionnaire [Hinting Task]		
Validated questionnaire [Eyes test instructions]		

IRAS project ID	211422

Appendix B - Summary of HRA Assessment

This appendix provides assurance to you, the sponsor and the NHS in England that the study, as reviewed for HRA Approval, is compliant with relevant standards. It also provides information and clarification, where appropriate, to participating NHS organisations in England to assist in assessing and arranging capacity and capability.

For information on how the sponsor should be working with participating NHS organisations in England, please refer to the, *participating NHS organisations, capacity and capability* and *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* sections in this appendix.

The following person is the sponsor contact for the purpose of addressing participating organisation questions relating to the study:

Name: Mr Alex Astor
Tel: 01517948739
Email: sponsor@liv.ac.uk

HRA assessment criteria

Section	HRA Assessment Criteria	Compliant with Standards	Comments
1.1	IRAS application completed correctly	Yes	No comments
2.1	Participant information/consent documents and consent process	Yes	No comments
3.1	Protocol assessment	Yes	No comments
4.1	Allocation of responsibilities and rights are agreed and documented	Yes	The sponsor has submitted the HRA Statement of Activities and intends for this to form the agreement between the sponsor and study sites. The sponsor is not requesting, and does not require any additional contracts with study sites.
4.2	Insurance/indemnity	Yes	Where applicable, independent contractors (e.g. General Practitioners)

Section	HRA Assessment Criteria	Compliant with Standards	Comments
	arrangements assessed		should ensure that the professional indemnity provided by their medical defence organisation covers the activities expected of them for this research study
4.3	Financial arrangements assessed	Yes	No application for external funding has been made. No study funding will be provided to sites, as detailed at Schedule 1 of the Statement of Activities.
5.1	Compliance with the Data Protection Act and data security issues assessed	Yes	No comments
5.2	CTIMPS – Arrangements for compliance with the Clinical Trials Regulations assessed	Not Applicable	No comments
5.3	Compliance with any applicable laws or regulations	Yes	No comments
6.1	NHS Research Ethics Committee favourable opinion received for applicable studies	Yes	REC Favourable Opinion was issued by the Liverpool East Research Ethics Committee on the 6th October 2016 Amended documents were submitted on by the researchers to comply with HRA Approval standards. These were classified by the sponsor as non-substantial amendment.
6.2	CTIMPS – Clinical Trials Authorisation (CTA) letter received	Not Applicable	No comments
6.3	Devices – MHRA notice of no objection received	Not Applicable	No comments
6.4	Other regulatory approvals and authorisations received	Not Applicable	No Comments

Participating NHS Organisations in England

This provides detail on the types of participating NHS organisations in the study and a statement as to whether the activities at all organisations are the same or different.
All participating NHS organisations will undertake the same study activities. There is therefore only one study site 'type' involved in the research. The Chief Investigator or sponsor should share relevant study documents with participating NHS organisations in England in order to put arrangements in place to deliver the study. The documents should be sent to both the local study team, where applicable, and the office providing the research management function at the participating organisation. For NIHR CRN Portfolio studies, the Local LCRN contact should also be copied into this correspondence. For further guidance on working with participating NHS organisations please see the HRA website. If chief investigators, sponsors or principal investigators are asked to complete site level forms for participating NHS organisations in England which are not provided in IRAS or on the HRA website, the chief investigator, sponsor or principal investigator should notify the HRA immediately at hra.approval@nhs.net. The HRA will work with these organisations to achieve a consistent approach to information provision.

Confirmation of Capacity and Capability

This describes whether formal confirmation of capacity and capability is expected from participating NHS organisations in England.
NHS organisations in England that are participating in the study **will be expected to formally confirm their capacity and capability** to host this research. • Following issue of this letter, participating NHS organisations in England may now confirm to the sponsor their capacity and capability to host this research, when ready to do so. How capacity and capacity will be confirmed is detailed in the Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria) section of this appendix. • The Assessing, Arranging, and Confirming document on the HRA website provides further information for the sponsor and NHS organisations on assessing, arranging and confirming capacity and capability.

Principal Investigator Suitability

This confirms whether the sponsor position on whether a PI, LC or neither should be in place is correct for each type of participating NHS organisation in England and the minimum expectations for education, training and experience that PIs should meet (where applicable).
A Principal Investigator should be appointed at study sites. GCP training is not a generic training expectation, in line with the HRA statement on training expectations.

HR Good Practice Resource Pack Expectations

This confirms the HR Good Practice Resource Pack expectations for the study and the pre-engagement checks that should and should not be undertaken
The sponsor has confirmed that members of the external research team will be attending sites to conduct study activities, as detailed in the Schedule of Events. A Letter of Access should therefore be sought. No additional pre-engagement checks will be required.

Other Information to Aid Study Set-up

This details any other information that may be helpful to sponsors and participating NHS organisations in England to aid study set-up.
The applicant has indicated that they **do not** intend to apply for inclusion on the NIHR CRN Portfolio.

Cheshire and Wirral Partnership NHS
NHS Foundation Trust

Research Office
Redesmere
Countess of Chester Health Park
Liverpool Road
Chester
CH2 1BQ

Tel: 01244 397394
Email: phil.elliott@cwp.nhs.uk

Standardised Process for Electronic Approval of Research

4th November, 2016

Paulo Sousa
20, Arch View Crescent
Liverpool
L1 7BA

Dear Paulo,

Re: NHS Permission for Research

Project Title: Testing the role of social isolation and social cognition in thought disorder.
Sponsor: University of Liverpool
SPEAR: 1501

Further to your request for permission to conduct the above research study at this Trust, we are pleased to inform you that this Trust has given NHS permission for the research to proceed.

Your NHS permission to conduct research at this site is only valid upon receipt of a signed 'Conditions for NHS Permission Reply Slip' which is enclosed.

Please take the time to read the attached conditions for NHS permission. Please contact the Research Office should you require any further information. You will need this letter as proof of NHS permission.

NHS permission for the above research has been granted on the basis described in your university application form and supporting documentation.

The documents reviewed were:

- Health Research Authority application and approval, IRAS 211422, dated 20/10/2016
- NHS ethics committee application and approval 16/NW/0647, dated 06/10/2016
- Protocol, v1.1, 18/06/2016
- Debrief sheet, v1.2, 06/10/2016
- Participant information sheet, v1.2, 28/09/2016
- Consent form, v1.1, 01/08/2016

Permission is granted on the understanding that the study is conducted in accordance with the Research Governance Framework, ICH GCP (if applicable), and NHS Trust policies and procedures. Permission is only granted for the activities for which a favourable opinion has been given by the Ethics Committee (where appropriate), and the study will be monitored at a later date.

May I wish you every success with your research.

Yours sincerely,

Phil Elliott

Dr Phil Elliott
Senior Research Facilitator on Behalf of:

PP Dr Pat Mottram
Research and Effectiveness Manager

Enc: Approval Conditions Leaflet

Study Title: Testing the role of social isolation and social cognition in thought disorder.

Conditions for NHS Permission Reply Slip: for reference.

In order for your NHS permission to be valid, please return this form to the address below to confirm that you have read and understood the conditions of NHS permission to conduct research.

1. I confirm that I have read and understand my duties and responsibilities as part of the conditions for permission to conduct research at this site.
2. I understand that I must submit the following information to the Trust's R&D department:
    - Recruitment figures on a monthly basis
    - New researcher details prior to them commencing on the research project
    - Any amendments submitted to the Ethics Committee
    - Changes to the status of the research project
    - Any urgent safety measure incorporated
    - Untoward Incidents and Unexpected Events within 24 hours of their occurrence
    - A final summary report
    - A copy of the Ethics letter confirming receipt of the End of Study Declaration
3. I understand I must complete and return in a timely manner any audit forms sent to me by the Trust.
4. I understand that I must gain permission from the Trust in order to publish or place information of the current research into the public domain.

Cheshire and Wirral Partnership NHS
NHS Foundation Trust

Research and Effectiveness Office
Redesmere
Countess of Chester Health Park
Chester
CH2 1BQ

Tel: 01244 397394
Email:phil.elliott@cwp.nhs.uk

Paulo Sousa
20, Arch View Crescent
Liverpool
L1 7BA

4th November, 2016

Dear Paulo,

Re: Letter of Access

Project Title: Testing the role of social isolation and social cognition in thought disorder.
Sponsor: University of Liverpool
SPEAR: 1501

We are satisfied that the research activities that you will undertake in this NHS organisation are commensurate with the activities you undertake for your employer. Your employer is fully responsible for ensuring such checks as are necessary have been carried out. Your employer has confirmed in writing to this NHS organisation that the necessary pre-engagement checks are in place in accordance with the role you plan to carry out in this organisation. This letter confirms your right of access to conduct research through **Cheshire and Wirral Partnership NHS Foundation Trust** for the purpose and on the terms and conditions set out below. This right of access commences **7th November, 2016** and ends on **31st December, 2017**, unless terminated earlier in accordance with the clauses below.

You have a right of access to conduct such research as confirmed in writing in the letter of permission for research from this NHS organisation. Please note that you cannot start the research until the Principal Investigator for the research project has received a letter from us giving permission to conduct the project.

You are considered to be a legal visitor to **Cheshire and Wirral Partnership NHS Foundation Trust** premises. You are not entitled to any form of payment or access to other benefits provided by this organisation to employees and this letter does not give rise to any other relationship between you and this NHS organisation, in particular that of an employee.

While undertaking research through **Cheshire and Wirral Partnership NHS Foundation Trust**, you will remain accountable to your employer **University of Liverpool/Mersey Care NHS Foundation Trust,** but you are required to follow the reasonable instructions of your nominated manager **Dr Pat Mottram, Research and**

Effectiveness Manager in this NHS organisation or those given on her/his behalf in relation to the terms of this right of access.

Where any third party claim is made, whether or not legal proceedings are issued, arising out of or in connection with your right of access, you are required to co-operate fully with any investigation by this NHS organisation in connection with any such claim and to give all such assistance as may reasonably be required regarding the conduct of any legal proceedings.

You must act in accordance **Cheshire and Wirral Partnership NHS Foundation Trust** with policies and procedures, which are available to you upon request, and the Research Governance Framework.

You are required to co-operate with **Cheshire and Wirral Partnership NHS Foundation Trust** in discharging its duties under the Health and Safety at Work etc Act 1974 and other health and safety legislation and to take reasonable care for the health and safety of yourself and others while on **Cheshire and Wirral Partnership NHS Foundation Trust** premises. Although you are not a contract holder, you must observe the same standards of care and propriety in dealing with patients, staff, visitors, equipment and premises as is expected of a contract holder and you must act appropriately, responsibly and professionally at all times.

You are required to ensure that all information regarding patients or staff remains secure and *strictly confidential* at all times. You must ensure that you understand and comply with the requirements of the NHS Confidentiality Code of Practice (http://www.dh.gov.uk/assetRoot/04/06/92/54/04069254.pdf) and the Data Protection Act 1998. Furthermore you should be aware that under the Act, unauthorised disclosure of information is an offence and such disclosures may lead to prosecution.

Cheshire and Wirral Partnership NHS Foundation Trust will not indemnify you against any liability incurred as a result of any breach of confidentiality or breach of the Data Protection Act 1998. Any breach of the Data Protection Act 1998 may result in legal action against you and/or your substantive employer.

You should ensure that, where you are issued with an identity or security card, a bleep number, email or library account, keys or protective clothing, these are returned upon termination of this arrangement. Please also ensure that while on the premises you wear your ID badge at all times, or are able to prove your identity if challenged. Please note that this NHS organisation accepts no responsibility for damage to or loss of personal property.

We may terminate your right to attend at any time either by giving seven days' written notice to you or immediately without any notice if you are in breach of any of the terms or conditions described in this letter or if you commit any act that we reasonably consider to amount to serious misconduct or to be disruptive and/or prejudicial to the interests and/or business of this NHS organisation or if you are convicted of any criminal offence. Where applicable, your substantive employer will initiate your Independent Safeguarding Authority (ISA) registration in-line with the phasing strategy adopted within the NHS and the applicable legislation. Once you are ISA-registered, your employer will continue to monitor your ISA registration status via the on-line ISA service. Should you cease to be ISA-registered, this letter of access is immediately terminated. Your substantive employer will immediately withdraw you from undertaking this or any other regulated activity and you MUST stop undertaking any regulated activity.

Your substantive employer is responsible for your conduct during this research project and may in the circumstances described above instigate disciplinary action against you.

If your circumstances change in relation to your health, criminal record, professional registration or ISA registration, or any other aspect that may impact on your suitability to conduct research, or your role in research changes, you must inform the organisation that employs you through its normal procedures. You must also inform your nominated manager in this NHS organisation.

Yours sincerely

Dr Phil Elliott
Senior Research Facilitator

From: **Bruce, Karen** Karen.Bruce@merseycare.nhs.uk
Subject: Project; 2016/26 De Sousa: Mersey Care NHS Foundation Trust - Confirmation of Capacity and Capability
Date: 4 November 2016 at 14:50
To: Paulo.Sousa@liverpool.ac.uk
Cc: sponsor@liv.ac.uk sponsor@liverpool.ac.uk, Parker, Pauline pauline.parker@merseycare.nhs.uk

KB

Dear Dr Brito de Sousa

Confirmation of Capacity and Capability at Mersey Care NHS Foundation Trust

Trust Ref	:	2016/26
Chief Investigator	:	Professor. Richard Bentall
Full title	:	Testing the role of social isolation and social cognition in thought disorder
IRAS	:	211422
REC ref:	:	16/NW/0647
Ethical approval	:	6th October, 2016
HRA approval	:	20th October, 2016
Attachment	:	Signed Agreement and/or agreed statement of activities

This email confirms that Mersey Care NHS Foundation Trust has the capacity and capability to deliver the above study.

This support is subject to the research team adhering to all statements in the IRAS application. In order to securely protect participant information and comply with Da should never be used to store personal information as they do not provide adequate security and are hosted outside the European Union. Any potential data breach team in the first instance on 0151 471 2638 for advice.

We agree to start this study on Monday 7th November, 2016. We are still awaiting confirmation from the EI service that they have the capacity to support your study a

Please send an email to Karen.bruce@merseycare.nhs.uk to confirm the date of your first recruit or if you have any concerns about recruiting your first Mersey Care pa

We look forward to working with you to successfully deliver this study.

If you wish to discuss further, please do not hesitate to contact myself or Karen.

Kind regards,

Pauline

Pauline A Parker ‖ R&D Manager ‖ R&D Department ‖ Building V7 ‖ Mersey Care NHS Foundation Trust Offices ‖
Kings Business Park ‖ Prescot ‖ Merseyside ‖ L34 1PJ ‖
Tel: 0151 471 2265 **Please note: telephone does not have voicemail**
Email: Pauline.parker@merseycare.nhs.uk

Kind regards
Karen
Karen Bruce,
Research & Development Assistant
R&D Department
Mersey Care NHS Foundation Trust Offices
V7 Kings Business Park
Prescot Merseyside L34 1PJ

Tel: 0151 471 2638 (voicemail available)
My work days are Tue – Fri
Karen.bruce@merseycare.nhs.uk

The NHS Constitution pledge to all patie
"to inform you of research studies in which you may be ei

Our registered headquarters is no longer at Princes Dock, Liverpool – our address is: Trust Headquarters Chief Executive and Chairman's Office, Mersey Car

Appendix Z. Debrief sheet

06/10/2016 version 1.2

Debrief sheet (script)

Title of Study: *Testing the role of social isolation and social cognition in thought disorder*

Researchers: Professor Richard Bentall, Professor William Sellwood and Dr. Paulo Sousa

Thank you for participating in the study: "Testing the role of social isolation and social cognition in thought disorder". This study is an investigation into the role of social isolation and social cognition (e.g. ability to recognise emotions and feelings in other peoples' faces) in thought and thinking difficulties in service users who have been diagnosed with psychosis. This study is important because it may lead to a better understanding of these experiences in psychosis and help us re-shape interventions that are currently being offered to service users.

In the study we ask participants to tell us about their experiences (e.g. voices or suspiciousness), to fill out a short questionnaire about the social support that they have in their life (e.g. friends, neighbours, relatives, etc.), and to complete two tasks. In one of the tasks, the participants have to identify emotions, feelings and/or emotional states in other people from images of their eyes. In the second task, the participants read a short story of two people talking in an everyday situation and are asked to tell us what the characters really mean or want but are not saying (i.e. the real intentions behind their words or their ulterior motives).

Our expectation is that being more isolated (i.e. less social support and contact with people) will make service users less able to identify emotions in other people's faces and to understand people's ulterior motives in a social situation and that this leads to service user being perceived as having thinking difficulties because he may struggle to understand where the listener is coming from.

Previous research has shown that service users that experience, or are perceived as having thought and thinking difficulties tend to be more isolated and they are also less accurate identifying emotions in other people or "reading" social situations and other people's ulterior motives. If you would like to learn more about this topic I can give you some references.

> Do you have any questions about the study? When you were doing it what did you think the study was about? Was there a part of the study that was difficult? What would you change about the study?

The nature of the questionnaire/interview is not meant to be distressing in any way. However, if the questionnaire/interview leads to distress, unpleasant memories or thoughts, we would encourage you to contact your General Practitioner. You may also wish to contact a mental health service, which does not require referral from a doctor or a nurse, such as the service(s) listed below.

Mental Health Liaison team (24 hour service based in the Accident and Emergency department)
Royal Liverpool University Hospital,
Prescot Street
Liverpool
L7 8XP
Tel: 0151 706 3520

If you would like, we can write you a letter with the results and findings of the study. It is really up to you. Again, thank you very much for your participation in our research. If you have any questions you can ask me now or you can contact me at a later date on (details below).

Paulo Sousa
Department of Clinical Psychology
University of Liverpool
Whelan Building
Brownlow Hill
Liverpool
L69 3GB
sousa@liv.ac.uk